Marginal Area Plan for the Missouri Portion of the St. Louis Nonattainment Area for the 2008 8-Hour Ground Level Ozone National Ambient Air Quality Standard

Prepared for the
Missouri Air Conservation Commission
Public Hearing: May 29, 2014

Missouri Department of Natural Resources
Division of Environmental Quality
Air Pollution Control Program
Jefferson City, Missouri

Project: 2008-O3-3-STL Marginal

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1. Introduction

1.1 Purpose

The purpose of this document is to fulfill the requirements of Section 182(a) of the Clean Air Act (CAA) for the Missouri portion of the St. Louis Marginal Ozone Nonattainment Area under the 2008 8-hour ground level ozone National Ambient Air Quality Standard (NAAQS). Section 182(a) of the CAA specifically addresses the State Implementation Plan (SIP) submissions and requirements for ozone nonattainment areas classified as Marginal. One of the main elements of Marginal Plans is CAA Section 182(a)(1) requiring the State to submit a comprehensive, accurate, current inventory of actual emissions from all sources within two years after designation. This is the only Section 182(a) element that the State has not already addressed in other plan submissions. Nonetheless, this document will address how the State has satisfied all the Marginal area plan elements for the St. Louis ozone nonattainment area.

The CAA Section 182(a) elements for marginal ozone nonattainment areas are outlined briefly below:

1. Comprehensive Current Emissions Inventory
2. Corrections to the State Implementation Plan (SIP)
    a. Pre- Clean Air Act Amendments of 1990 Reasonable Available Control Technology (RACT)
    b. Savings Clause For Vehicle Inspection and Maintenance
    c. New Source Review (NSR) Permit Program
3. Commitment to Periodic Inventory Updates
4. Requirement for NSR Offsets

1.2 Background

On March 27, 2008, the U.S. Environmental Protection Agency (EPA) released a revised 8-hour ozone standard [73 FR 16436]. This revision lowers the ozone standard to 0.075 ppm (or 75 ppb). With a revised NAAQS, the CAA requires states to review air quality monitoring data and submit ozone boundary designation recommendations. In March 2009, Missouri submitted its original boundary recommendation for the 2008 ozone NAAQS to EPA, based on the ozone air quality monitoring data for the three years of 2005–2007. Then in December 2011, Missouri updated the boundary recommendations based on air quality data for the three years of 2008–2010. More information on Missouri's boundary designation recommendations may be found at: http://dnr.mo.gov/env/apcp/naaqsboundarydesignations.htm.

On May 21, 2012, EPA finalized the area designations. The St. Louis area was designated nonattainment area and classified as marginal for the 2008 ozone standard [77 FR 30088]. The boundaries of the Missouri portion of the nonattainment area remained the same as for the 1997 ozone standard but its classification changed from moderate. Marginal nonattainment areas have until December 31, 2015 to attain the 2008 Ozone NAAQS [40 CFR 51.1103].

Since the St. Louis Ozone Area is a bi-state nonattainment area, Illinois went through a similar designation process for its portion – the Metro-East side of the St. Louis area. For the Illinois portion under the 2008 ozone NAAQS, Jersey County is no longer designated as nonattainment as it was for the 1997 ozone standard. For more information on EPA's final state designations, see - http://www.epa.gov/glo/designations/2008standards/state.htm.

The following is a list of the eight counties contained in the St. Louis **Missouri**-Illinois 2008 8-hour Ozone Marginal Nonattainment Area:

- **St. Louis County, MO**
- **St. Louis City, MO**
- **St Charles, MO**
- **Jefferson County, MO**
- **Franklin County, MO**
- Madison County, IL
- St. Clair County, IL
- Monroe County, IL

Although not a requirement for this Marginal Area plan submission under CAA Section 182(a), Transportation Conformity applies one year after the effective date of nonattainment designations for the 2008 ozone NAAQS, i.e., July 20, 2013. As a result, on January 30, 2013, East-West Gateway Council of Governments, the designated Metropolitan Planning Organization for the greater St. Louis area, approved a Transportation Conformity Determination addressing the 2008 NAAQS. In addition, an Early Progress Plan establishing Motor Vehicle Emission Budgets (MVEBs) for Transportation Conformity purposes under the 2008 ozone standard has been developed by the Air Program in a previous SIP submission. This Early Progress Plan was adopted by the Missouri Air Conservation Commission on March 28, 2013. The Air program submitted the plan to EPA on August 16, 2013 and EPA deemed the new budgets adequate on March 5, 2014 [79 FR 12504]. More information on the Early Progress Plan may be found at: http://www.dnr.mo.gov/env/apcp/docs/complete-epp-submittal-8-16-13.pdf.

More information on the history and background of the St. Louis ozone nonattainment area, as well as the effects of ozone, may be found in Missouri's previous ozone plan submittals at http://www.dnr.mo.gov/env/apcp/sips.htm#ozone.

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2. Marginal Area Plan Requirements

As stated above, this plan submittal satisfies Missouri's obligations for the St. Louis Marginal nonattainment area under the 2008 ozone NAAQS. CAA Section 182(a) lists the required elements for ozone marginal area plan submissions. Within this chapter of the plan, each section below corresponds to a CAA Section 182(a) element and provides an explanation of how the State of Missouri fulfills each element.

2.1 Emissions Inventory: Section 182(a)(1)

Section 182(a)(1) of the CAA states that —

> *Within 2 years….the State shall submit a comprehensive, accurate, current inventory of the actual emissions from all sources, as described in Section 172(c)(3), in accordance with guidance provided by the Administrator.*

In coordination with EPA staff, the Air Program has developed a complete ozone season day emission inventory for the year 2011 of the actual emissions of the pollutants that contribute to ozone formation in the St. Louis nonattainment area: volatile organic compounds (VOC), oxides of nitrogen (NO_x), and carbon monoxide (CO). The year 2011 corresponds to the most recent triennial statewide emissions inventory conducted for the National Emissions Inventory (NEI) pursuant to the federal Air Emissions Reporting Requirements (AERR) rule [73 FR 76539; December 17, 2008]. This inventory conforms to EPA's latest guidance: *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations* [November 2005].

The 2011 ozone season day emissions inventory for the St. Louis nonattainment area is presented in Appendix A, which includes emissions from stationary point and area sources, onroad mobile, nonroad, event (i.e. wildfire), and biogenic sources within the five Missouri counties of the bi-state area. Appendix A also outlines the methodology and calculations used to convert the annual emission rates from the 2011 NEI into ozone season daily emission rates. The ozone season daily emissions in Appendix A apply to emissions occurring during a typical weekday of the high ozone season, which is June through August.

Appendix B provides the documentation for Missouri's most recent NEI submittal which accounts for all Criteria and Hazardous Air Pollutants in the entire state during 2011.

Table 1 displays the 2011 anthropogenic emissions inventory summary for the Missouri portion of the 2008 St. Louis ozone nonattainment area in tons per ozone season day. The anthropogenic source categories include point, area, on-road mobile, and non-road sources. Additional details regarding the development the 2011 ozone season day anthropogenic emissions inventory for the Missouri portion of the nonattainment area can be found in Appendices A-2 through A-7.

Table 2 displays the 2011 emissions inventory summary for the biogenic and wildfire (event) source categories in the Missouri portion of the 2008 St. Louis ozone nonattainment area in tons per ozone season day. Event emissions include wild fire emissions, prescribed burning and

agricultural burning; however, when annual emissions from these three event source categories are temporally allocated to ozone season day emissions, only wild fire emissions are projected to occur during the high ozone season. Additional details regarding the development the 2011 ozone season day biogenic and wildfire emissions inventory for the Missouri portion of the nonattainment area can be found in Appendix A-6.

Table 1 2011 Anthropogenic Emissions Inventory Summary for the Missouri Portion of the Nonattainment Area (tons/ozone season day)

County Name	Source Category	VOC	NO_x	CO
Franklin County	Point Sources	2.52	27.75	7.55
Jefferson County		1.63	16.66	7.23
St. Charles County		3.34	25.04	2.82
St. Louis County		3.5	16.74	17.68
St. Louis City		3.59	4.49	7.36
Totals *		**14.58**	**90.69**	**42.65**
Franklin County	Area Sources	3.36	0.49	3.03
Jefferson County		7.48	0.62	8.14
St. Charles County		11.21	0.68	1.35
St. Louis County		38.68	2.65	4.72
St. Louis City		12.04	1.16	1.76
Totals *		**72.77**	**5.6**	**19.01**
Franklin County	Onroad Mobile Sources	2.40	7.83	21.18
Jefferson County		4.24	12.45	34.91
St. Charles County		6.73	21.04	56.63
St. Louis County		20.17	66.34	176.34
St. Louis City		4.46	16.55	42.14
Totals *		**38.00**	**124.20**	**331.20**
Franklin County	Nonroad Sources	3.31	5.72	18.55
Jefferson County		3.12	3.33	28.68
St. Charles County		6.23	8.34	62.81
St. Louis County		22.99	23.85	315.24
St. Louis City		3.38	6.31	48.14
Totals *		**39.03**	**47.55**	**473.42**
Grand Total *		**164.38**	**268.04**	**866.28**

* Note: Figures may not total exactly due to rounding.

Table 2 2011 Wildfire and Biogenic Emissions Inventory Summary for the Missouri Portion of the Nonattainment Area (tons/ozone season day)

County Name	Source Category	VOC	NO_x	CO
Franklin County	Wild Fires (Event)	0.09	0.00	0.40
Jefferson County		0.07	0.00	0.28
St. Charles County		0.00	0.00	0.01
St. Louis County		0.00	0.00	0.01
St. Louis City		0.00	0.00	0.00
Totals *		**0.16**	**0.01**	**0.69**
Franklin County	Biogenic Sources	126.84	1.09	11.58
Jefferson County		104.17	0.51	9.29
St. Charles County		65.94	1.05	7.09
St. Louis County		60.84	0.68	5.55
St. Louis City		10.93	0.13	1.03
Totals *		**368.71**	**3.47**	**34.55**

* Note: Figures may not total exactly due to rounding.

2.2 Corrections to the State Implementation Plan: Section 182(a)(2)

The second element of a Marginal Area plan is found in CAA Section 182(a)(2) which requires the State to submit a revision to the SIP for certain "corrections" to Reasonably Available Control Technology (RACT), Vehicle Inspection and Maintenance (I/M), and New Source Review (NSR) Permit programs. These three provisions are addressed in the corresponding three subsections below.

2.2.A Reasonably Available Control Technology

Section 182(a)(2)(A) refers to the first round of ozone area designations/classifications after the promulgation of the amendments to the Clean Air Act in 1990 and gives the State six months after these initial classifications to revise SIPs with corrections to the pre-1990 CAA RACT levels pursuant to EPA-issued guidance. Since the 2008 ozone NAAQS is a revision to the standard that existed in 1990 and outside the timeframe mentioned, this requirement is no longer applicable to this Marginal Area plan. Nevertheless, RACT evaluations are continuous and ongoing for the St. Louis ozone nonattainment area. Missouri has previously addressed RACT requirements in the St. Louis nonattainment area in developing attainment plans for the 1-hour ozone standard. For the 1997 8-hour ozone standard, the Air Program developed a RACT demonstration as an element to the moderate ozone nonattainment area SIP revision. Per the federal implementation rule for the 1997 ozone standard, the RACT demonstration was to be submitted as a separate element prior to the submittal of the attainment demonstration and other elements of the SIP revision. The RACT plan was adopted on December 7, 2006 and submitted to the EPA on January 5, 2007.

Shortly thereafter, EPA issued some new Control Techniques Guidelines (CTGs) for VOC sources to be used as 'presumptive' RACT. Since these new CTGs were not considered in the 2006 RACT demonstration, and in an effort to ensure that RACT levels for the St. Louis nonattainment area are current, the Air Program developed an update to the 2006 RACT demonstration. This RACT plan also supports the attainment redesignation request for the

Missouri portion of the St. Louis area under the 1997 ozone standard. This updated RACT demonstration showed how RACT for VOCs has been appropriately upgraded since the last RACT submittal. This updated VOC RACT document was adopted by the MACC on April 28, 2011 and submitted to EPA on May 25, 2011. EPA approved this RACT plan into the SIP on January 6, 2014 [79 FR 580].

For a more detailed discussion of RACT issues, please refer to the updated RACT demonstration adopted April 28, 2011, which can be found at http://dnr.mo.gov/env/apcp/sips.htm#ozone

2.2.B Savings Clause for Vehicle Inspection and Maintenance

The savings or "anti-backsliding" clause of Section 182(a)(2)(B) requires states to maintain any ozone nonattainment area's existing vehicle I/M program at an equivalent-or-better level after that area is classified as Marginal.

The State of Missouri has operated a vehicle emissions inspection and maintenance program in the St. Louis area for over 30 years. State rule, 10 CSR 10-5.381 *On-Board Diagnostics Motor Vehicle Emissions Inspection*, implements the current program called Gateway Vehicle Inspection Program (GVIP). This program has accounted for significant reductions of NO_x and VOC emissions from the mobile sector in the St. Louis nonattainment area. Missouri is committed to maintaining an equally stringent I/M program into the future. The Air Program intends to submit any changes to the current I/M program as revisions to the Missouri SIP. In satisfaction of the I/M savings clause, the Air Program asserts that if any changes to the I/M program could potentially alleviate mobile source emission controls in the St. Louis area, then the SIP revision shall contain an "anti-backsliding" demonstration under Section 110(l) of the Clean Air Act.

2.2.C New Source Review Permit Programs

Per CAA Section 182(a)(2)(C) a Marginal Area plan submission shall include —

> *provisions to require permits, in accordance with sections 172(c)(5) and 173, for the construction and operation of each new or modified major stationary source (with respect to ozone) to be located in the area.*

In accordance with the Clean Air Act, Missouri has a long-standing and fully implemented New Source Review (NSR) permitting program for new major sources and significant modifications of existing sources enabled by State rule 10 CSR 10-6.060 *Construction Permits Required.*

Such a permit program in any attainment area is referred to as a Prevention of Significant Deterioration (PSD) permitting program and is governed by Section (8) of 10 CSR 10-6.060. Missouri's PSD program is addressed in Missouri's CAA Section 110 Infrastructure Requirements Plan for the 2008 ozone NAAQS. For more information on that plan, see http://www.dnr.mo.gov/env/apcp/docs/epa-submittal-2008-ozone-infra-sip.pdf.

In compliance with Section 182(a)(2)(C), Missouri's NSR permitting program also regulates the construction of new and modified major stationary sources in nonattainment areas, such as the

St. Louis ozone nonattainment area, via Section (7) of 10 CSR 10-6.060. Missouri has been delegated full authority to implement its NSR program by the EPA.

Three distinct features of the Nonattainment NSR program, on new major sources or significant modification of existing major sources, are —

1. the implementation of Lowest Achievable Emission Rate (LAER),
2. alternate site analysis, and
3. emission offset reductions (offsets).

2.3 Periodic Inventory: Section 182(a)(3)

The third element of a Marginal Area plan is found in CAA Section 182(a)(3). This section requires that the State submit a periodic emissions inventory similar to that required in 2.1 of this document at least as often as every three years until the area is redesignated to attainment [(182(a)(3)(A)]. Furthermore, the State shall require certain sources of NO_x and VOCs to report their actual emissions of these ozone precursors every year in an emissions statement for the purpose of developing current, comprehensive and accurate emission inventories [(182(a)(3)(B)].

The State of Missouri is committed to providing future emissions inventory updates at least every three years to enable tracking of ozone-precursor emissions levels in the St. Louis nonattainment area. State Regulation 10 CSR 10-6.110 *Reporting Emission Data, Emission Fees, and Process Information* requires permitted sources to file an annual report on air pollutant emissions to include emissions data, process information, and annual emissions fees. These sources report their emissions on a form called an Emissions Inventory Questionnaire (EIQ) developed by the Air Program pursuant to 10 CSR 10-6.110. EIQs may be filed electronically and emissions data are tracked though Missouri's Emissions Inventory System (MOEIS). For applicable NO_x and VOC sources in the St. Louis nonattainment area, the EIQs include an ozone-specific worksheet.

The methods for calculating and reporting their emissions are detailed in each installation's applicable permit. The data collected in MOEIS from the EIQs form the basis of the point source emissions inventory that is compiled on an annual basis. In addition, in compliance with the federal Air Emission Reporting Rule, the Air program develops a comprehensive emissions inventory of point, area, and mobile sources every three years, covering both annual and ozone season day emissions. The Air Program submits this emissions data to EPA for inclusion in the publicly-available NEI and uses the data for tracking progress towards attaining and maintaining the NAAQS, developing control and maintenance strategies, identifying sources and general emission levels, and determining compliance with emissions regulations as well as other EPA requirements. The Air Program also makes data, including NO_x and VOC emissions data, available to the public upon request.

2.4 General Offset Requirement: Section 182(a)(4)

The fourth and final Marginal Area plan provision of CAA Section 182(a) is the General Offset Requirement. For the purposes of the Nonattainment NSR permitting program for new and modified major stationary sources, the State must establish, in its Marginal Area plan

submission, the emission offset ratio of total VOC emission reductions to total increased VOC emissions to be at least 1.1 to 1.

As mentioned above in 2.2.C, Missouri has a well-established NSR or major source construction permit program. One of the unique features of NSR for nonattainment areas is the requirement for emission offset reductions. This is codified at 10 CSR 10-6.060(7)(B)1.:

> *By the time the source is to commence operation, sufficient emissions offsets shall be obtained as required to ensure reasonable further progress toward attainment of the applicable national ambient air quality standard and consistent with the requirements of Section 173(a)(1)(A) of the Clean Air Act and paragraphs 40 CFR 51.165(a)(3) and (9);*

The corresponding offset ratio for each ozone area classification (i.e. 1.1:1 for Marginal) is found in federal code at 40 CFR 51.165(a)(3)(9) per the citation above. Thus Missouri has satisfied the CAA Section 182(a)(4) requirement for Marginal Area Plan submissions in establishing a Marginal Area emission offset reduction ratio of 1.1:1 in its NSR program by SIP-approved rule consistent with the corresponding federal code.

3. Conclusion

Through this plan submission, Missouri asserts that it has satisfied all of its Marginal Area Plan submission obligations for the Missouri-portion of the St. Louis bi-state nonattainment area pursuant to federal Clean Air Act Section 182(a) under the 2008 ozone 8-hour National Ambient Air Quality Standard. Attached with this document is a complete, comprehensive, accurate and current inventory of ozone-precursor emissions for the St. Louis nonattainment area. Moreover, this plan administratively addresses three other elements of a Marginal Area Plan submission under CAA Section 182(a). The Air Program requests that EPA approve this plan submission for inclusion into the Missouri State Implementation Plan.

Appendix A

2011 Ozone Season Day Emissions Inventory for the Missouri Portion of the St. Louis Nonattainment Area

Missouri Department of Natural Resources
Division of Environmental Quality
Air Pollution Control Program
Jefferson City, Missouri

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Appendix A-1 2011 Ozone Season Day Emissions Inventory Summary for the Missouri Portion of the 2008 St. Louis Ozone Nonattainment Area

Table A-1 displays the 2011 anthropogenic emissions inventory summary for the Missouri portion of the 2008 St. Louis ozone nonattainment area in tons per ozone season day. The anthropogenic source categories include point, area, onroad mobile, and nonroad sources. Additional details regarding the development the 2011 ozone season day anthropogenic emissions inventory for the Missouri portion of the nonattainment area can be found in Appendices A-2 through A-7.

Table A-1 2011 Anthropogenic Emissions Inventory Summary for the Missouri Portion of the Nonattainment Area (tons/ozone season day)

County Name	Source Category	CO	NO_X	VOC
Franklin County	Point Sources	7.55	27.75	2.52
Jefferson County		7.23	16.66	1.63
St. Charles County		2.82	25.04	3.34
St. Louis County		17.68	16.74	3.5
St. Louis City		7.36	4.49	3.59
Totals *		**42.65**	**90.69**	**14.58**
Franklin County	Area Sources	3.03	0.49	3.36
Jefferson County		8.14	0.62	7.48
St. Charles County		1.35	0.68	11.21
St. Louis County		4.72	2.65	38.68
St. Louis City		1.76	1.16	12.04
Totals *		**19.01**	**5.6**	**72.77**
Franklin County	Onroad Mobile Sources	21.18	7.83	2.40
Jefferson County		34.91	12.45	4.24
St. Charles County		56.63	21.04	6.73
St. Louis County		176.34	66.34	20.17
St. Louis City		42.14	16.55	4.46
Totals *		**331.20**	**124.20**	**38.00**
Franklin County	Nonroad Sources	18.55	5.72	3.31
Jefferson County		28.68	3.33	3.12
St. Charles County		62.81	8.34	6.23
St. Louis County		315.24	23.85	22.99
St. Louis City		48.14	6.31	3.38
Totals *		**473.42**	**47.55**	**39.03**
Grand Total *		**866.28**	**268.04**	**164.38**

* Note: Figures may not total exactly due to rounding.

Table A-2 displays the 2011 emissions inventory summary for the biogenic and wildfire (event) source categories in the Missouri portion of the 2008 St. Louis ozone nonattainment area in tons per ozone season day. Event emissions include wild fire emissions, prescribed burning and agricultural burning; however, when annual emissions from these three event source categories are temporally allocated to ozone season day emissions, only wild fire emissions are projected to occur during the high ozone season. Additional details regarding the development the 2011 ozone season day biogenic and wildfire emissions inventory for the Missouri portion of the nonattainment area can be found in Appendix A-6.

Table A-2 2011 Wildfire and Biogenic Emissions Inventory Summary for the Missouri Portion of the Nonattainment Area (tons/ozone season day)

County Name	Source Category	CO	NOX	VOC
Franklin County	Wild Fires (Event)	0.40	0.00	0.09
Jefferson County		0.28	0.00	0.07
St. Charles County		0.01	0.00	0.00
St. Louis County		0.01	0.00	0.00
St. Louis City		0.00	0.00	0.00
Totals *		**0.69**	**0.01**	**0.16**
Franklin County	Biogenic Sources	11.58	1.09	126.84
Jefferson County		9.29	0.51	104.17
St. Charles County		7.09	1.05	65.94
St. Louis County		5.55	0.68	60.84
St. Louis City		1.03	0.13	10.93
Totals *		**34.55**	**3.47**	**368.71**

* Note: Figures may not total exactly due to rounding.

Appendix A-2 2011 Point Source Emissions

The 2011 point source emissions by county for the Missouri portion of the 2008 St. Louis ozone nonattainment area are summarized below in Table A-3. The emissions are based on actual ozone season emissions reported by facilities located in the St. Louis nonattainment area and are given in units of tons/average ozone season day. See Appendix B for additional information regarding the documentation of the point source inventory including quality assurance measures used to ensure accuracy of the data submitted.

Table A-3 2011 Point Source Emissions Inventory Summary for the Missouri Portion of the St. Louis Ozone Nonattainment Area (tons/ozone season day)

County Name	CO	NO_X	VOC
Franklin County	7.55	27.75	2.52
Jefferson County	7.23	16.66	1.63
St. Charles County	2.82	25.04	3.34
St. Louis County	17.68	16.74	3.5
St. Louis City	7.36	4.49	3.59
Totals	**42.65**	**90.69**	**14.58**

EPA's 2011 National Emissions Inventory (NEI) includes point source emissions for aircraft takeoffs and landings. However, in this document theses are classified as nonroad source emissions. Therefore, the emissions for aircraft takeoffs and landings are not included in the total point source emissions listed above in Table A-3. The SCC codes for the aircraft categories are listed in Table A-7, and the emissions from these categories are included in Table A-18, to be included as nonroad source emissions.

Table A-4 2011 Point Source Emissions by Facility for the Missouri Portion of the St. Louis Ozone Nonattainment Area (tons/ozone season day)

FIPS	Plant ID	Facility Site Name	CO (tons/ozone season day)	NO_X (tons/ozone season day)	VOC (tons/ozone season day)
071	0003	AMEREN MISSOURI – LABADIE PLANT	7.54655	27.71852	0.90532
071	0013	SPORLAN DIVISION PLANT #1	0.00161	0.00192	0.04552
071	0014	CANAM STEEL CORP	-	0.00601	0.18059
071	0020	STEELWELD EQUIPMENT CO INC	0.00042	0.00050	0.02101
071	0031	GRAPHIC PACKAGING INTERNATIONAL	-	-	0.10302
071	0068	MERAMEC INDUSTRIES INC	0.00011	0.00050	0.20540
071	0080	SPARTAN SHOWCASE INC	-	-	0.03872
071	0087	BULL MOOSE TUBE COMPANY	0.00083	0.00143	0.10022
071	0131	SULLIVAN PRECISION METAL FINISHING INC	-	-	0.01369
071	0132	SPORLAN VALVE DIVSION	-	-	0.09218
071	0151	AEROFIL TECHNOLOGY INC	0.00010	0.00050	0.12041
071	0153	MAGNET LLC	-	-	0.03066
071	0154	PRECISION STONE FABRICATORS	-	-	-
071	0155	EATON FUNERAL HOME	-	-	-
071	0157	PLAZE INCORPORATED	0.00126	0.00600	0.24811
071	0173	HENNIGES AUTOMOTIVE SEALING SYSTEMS NA	-	0.00140	0.02092
071	0178	SPORLAN VALVE DIVISION	-	-	0.06077
071	0181	CG POWER SYSTEMS USA INC	0.00130	0.00650	0.14223
071	0195	AMTECO INC	-	-	0.06274
071	0205	TRUE MANUFACTURING COMPANY	-	-	0.07050
071	0230	PLAZE, INC	0.00168	0.00200	0.05639
Franklin County Totals			**7.55**	**27.75**	**2.52**
099	0002	RIVER CEMENT CO. DBA BUZZI UNICEM USA	3.21133	5.57373	0.52559
099	0003	DOE RUN COMPANY	0.04941	0.02645	0.00468
099	0007	FRED WEBER INC	0.03623	0.19085	0.00354
099	0011	UNION PACIFIC RAILROAD CO	0.00480	0.00641	0.12168
099	0012	TRAUTMAN QUARRY	-	-	-
099	0014	DOW CHEMICAL COMPANY, THE	-	-	0.00335
099	0016	AMEREN MISSOURI – RUSH ISLAND PLANT	3.67401	10.18312	0.44058
099	0044	METAL CONTAINER CORPORATION	0.04959	0.05903	0.27132
099	0052	ENGINEERED COIL COMPANY	-	-	0.01837

FIPS	Plant ID	Facility Site Name	CO (tons/ozone season day)	NO_X (tons/ozone season day)	VOC (tons/ozone season day)
099	0068	SAINT-GOBAIN CONTAINERS INC	0.02509	0.29422	0.07256
099	0072	SHAPIRO BROTHERS INC	0.03461	0.13030	0.00366
099	0092	MASTERCHEM INDUSTRIES INC	-	-	-
099	0098	FRED WEBER INC	0.00600	0.00617	0.00052
099	0103	BUSSEN QUARRIES INC	-	-	-
099	0111	CARONDELET CORPORATION	0.00747	0.01425	0.10006
099	0114	AERO METAL FINISHING	-	0.00592	0.00596
099	0116	SINCLAIR & RUSH	0.13246	0.17064	0.05719
Jefferson County Totals			**7.23**	**16.66**	**1.63**
183	0001	AMEREN MISSOURI – SIOUX PLANT	2.42945	24.34778	0.53534
183	0004	FRED WEBER INC	0.11464	0.00717	0.00235
183	0010	BOEING COMPANY	0.00210	0.00250	0.02220
183	0012	MIDWEST PRECISION CASTING COMPANY	-	-	-
183	0019	ST. JOSEPH HEALTH CENTER	0.01024	0.03016	0.00229
183	0023	MAGELLAN TERMINALS HOLDINGS LP	-	-	0.08402
183	0027	MEMC ELECTRONIC MATERIALS INC	0.02567	0.03214	0.01403
183	0029	RECKITT BENCKISER	-	-	0.00594
183	0038	LEONARD'S METAL INC	-	-	0.00883
183	0076	GENERAL MOTORS LLC	0.21983	0.57689	2.10815
183	0077	O'FALLON CASTING LLC	0.00336	0.00400	0.06600
183	0110	ZOLTEK CORPORATION	0.00880	0.03964	0.00239
183	0129	WOODBRIDGE CORPORATION	-	-	0.34611
183	0131	SUPERIOR HOME PRODUCTS INC	-	-	0.02789
183	0184	TRUE MANUFACTURING CO	0.00210	0.00250	0.10233
183	0241	PITMAN CREMATION SERVICES	-	-	-
183	6003	LAMI WOOD PRODUCTS	-	-	0.01514
St. Charles County Totals			**2.82**	**25.04**	**3.34**
189	0010	AMEREN MISSOURI – MERAMEC PLANT	12.12538	14.53689	0.32222
189	0020	MONSANTO WORLD HEADQUARTERS	0.01687	0.03635	0.00126
189	0022	ST. JOHNS MERCY MEDICAL CNTR/MAINTENANCE	0.02394	0.02850	0.00237
189	0023	AMEREN MISSOURI	0.00076	0.01100	0.00027
189	0032	MONSANTO	0.06598	0.22951	0.00628
189	0035	ROCKWOOD PIGMENTS NA INC	0.02111	0.03000	0.00181

FIPS	Plant ID	Facility Site Name	CO (tons/ozone season day)	NO_X (tons/ozone season day)	VOC (tons/ozone season day)
189	0040	PACE CONSTRUCTION CO.	0.16299	0.01015	0.00502
189	0042	WASHINGTON UNIVERSITY	0.13510	0.47994	0.03494
189	0057	ST. LOUIS POST-DISPATCH	0.00084	0.00100	0.03506
189	0061	CARAUSTAR INDUSTRIES INC.	-	-	0.07993
189	0064	SUNNEN PRODUCTS COMPANY	0.00168	0.00200	0.02260
189	0065	ST. LOUIS AIRPORT AUTHORITY	0.01742	0.04972	0.04427
189	0069	THE QUIKRETE COMPANIES, INC.	0.00420	0.00500	0.00028
189	0111	MISSOURI ASPHALT PRODUCTS, LLC	0.07635	0.02291	0.00157
189	0140	STOUT MARKETING	0.00234	0.00279	0.03392
189	0141	ENERGY PETROLEUM COMPANY	-	-	0.02155
189	0201	PACE CONSTRUCTION CO	0.09940	0.04125	0.03625
189	0208	PRINTPACK INC	0.01092	0.01300	0.28613
189	0217	METROPOLITAN ST. LOUIS SEWER DISTRICT	0.84692	0.13660	0.04978
189	0226	GREIF-FENTON	0.00630	0.00750	0.17079
189	0230	THE BOEING COMPANY	0.03736	0.07778	0.13709
189	0231	CHRYSLER GROUP LLC	-	-	-
189	0238	ST. LOUIS LITHOGRAPHING COMPANY	-	-	0.06951
189	0281	BFI MISSOURI PASS LANDFILL	0.18000	0.00960	0.00623
189	0282	CENVEO ST. LOUIS	-	-	-
189	0308	IESI MO CHAMP LANDFILL	0.54750	0.02920	0.02625
189	0310	ADVANCED DISPOSAL SERVICES	0.33375	0.01780	0.01175
189	0312	BRIDGETON LANDFILL, LLC	0.59625	0.03180	0.02013
189	0315	FOL TAPE LLC	-	-	0.09862
189	0317	PRO-TECT MFG INC	-	-	0.09000
189	0318	ST. MARYS HEALTH CENTER	0.01092	0.01300	0.00072
189	0326	AIR PRODUCTS-PRISM MEMBRANES	0.00252	0.00300	0.15873
189	0327	CAMIE-CAMPBELL INC	-	-	0.01370
189	1012	BELT SERVICE CORP	-	-	0.16005
189	1015	KV PHARMACEUTICAL COMPANY	-	-	0.10930
189	1029	SSM DEPAUL HEALTH CENTER	0.01848	0.01835	0.00121
189	1047	NESHER PHARMACEUTICALS	-	-	0.14988
189	1065	MISSOURI AIR NATIONAL GUARD	1.26847	0.15057	0.08346
189	1071	INTELLIGRATED	-	0.00482	0.02418
189	1093	BODINE ALUMINUM INC	0.01722	0.03182	0.01034

FIPS	Plant ID	Facility Site Name	CO (tons/ozone season day)	NO_X (tons/ozone season day)	VOC (tons/ozone season day)
189	1097	REICHHOLD, INC	0.01050	0.01250	0.09001
189	1101	ST. LUKE'S HOSPITAL	0.01470	0.01750	0.00096
189	1196	MALLINCKRODT LLC	0.00840	0.01000	0.03222
189	1204	BASF PESTICIDE CONTROL SOLUTIONS	-	-	0.02270
189	1205	MSD, MISSOURI RIVER WWTP	0.02259	0.24356	0.03079
189	1210	MSD, COLDWATER CREEK WWTP	-	-	0.00044
189	1226	SIMPSON CONSTRUCTION MATERIALS LLC	0.13946	0.04135	0.01321
189	1247	QUEST LITHOGRAPHICS LLC	-	-	0.08389
189	1248	FRED WEBER INC. - SOUTH ASPHALT (BATCH)	0.15807	0.01055	0.00324
189	1249	FRED WEBER INC - NORTH ASPHALT H AND B	0.23735	0.03260	0.01048
189	1250	FRED WEBER INC. - NORTH ASPHALT B-G	0.08312	0.00660	0.00003
189	1259	MACLAN INDUSTRIES	-	-	0.01280
189	1269	GLIDEAWAY MFG COMPANY	0.00003	0.00003	0.03085
189	1316	SINCLAIR AND RUSH	-	-	0.04000
189	1470	SOUTHERN GRAPHIC SYSTEMS	-	-	0.05113
189	1474	LACLEDE GAS COMPANY - UGS	0.18278	0.13152	0.02483
189	1481	MANOR CHEMICAL COMPANY INC	-	-	0.03683
189	1489	GKN AEROSPACE NORTH AMERICA, INC.	0.02016	0.01163	0.18336
189	1501	PEERLESS PARK LANDFILL	0.03589	0.00191	0.00134
189	1515	FRED WEBER INC. - CRUSHING PLANT #7	0.00592	0.02748	0.00224
189	1516	J.D. STREETT AND COMPANY INC	-	-	0.04234
189	1520	F AND S PRINTING	-	-	0.19075
189	1521	PACE CONSTRUCTION CO	0.10403	0.06333	0.02749
189	1523	MISSOURI VALLEY ASPHALT LLC	0.00260	0.00110	0.00064
189	1534	A.G. RECYCLING	0.01944	0.09025	0.00716
189	1538	NESHER PHARMACEUTICALS	-	-	0.03819
189	1541	PACKAGING CONCEPTS INC	0.00672	0.00800	0.09571
189	1590	CENVEO - ST. LOUIS	0.00210	0.00250	0.09646
St. Louis County Totals			**17.68**	**16.74**	**3.50**
510	0003	ANHEUSER-BUSCH INC	0.23429	1.42882	0.65663
510	0016	J.D. STREETT	-	-	0.08579
510	0017	MALLINCKRODT LLC	0.11996	0.22153	0.18214
510	0027	PRECOAT METALS	0.03150	0.03750	0.19785

FIPS	Plant ID	Facility Site Name	CO (tons/ozone season day)	NO_X (tons/ozone season day)	VOC (tons/ozone season day)
510	0031	ADM GRAIN COMPANY	0.00126	0.00150	0.00008
510	0035	BUCKEYE TERMINALS LLC	-	-	0.08275
510	0036	BUCKEYE TERMINALS LLC	0.00659	0.00785	0.00609
510	0038	TRIGEN-ST. LOUIS ENERGY CORP	0.06846	0.09080	0.00501
510	0040	WASHINGTON UNIV MEDICAL SCHOOL	0.02682	0.11721	0.00818
510	0047	FRED WEBER INC	0.02597	0.00231	0.00054
510	0053	METROPOLITAN ST. LOUIS SEWER DISTRICT	5.41682	0.92459	0.26332
510	0057	PROCTER AND GAMBLE	0.09201	0.10960	0.01218
510	0063	THE DIAL CORPORATION	0.00336	0.00400	0.00022
510	0066	ELEMENTIS SPECIALTIES INC	0.01134	0.01350	0.20137
510	0070	ICL PERFORMANCE PRODUCTS LP	0.06566	0.02414	0.00332
510	0096	ELANTAS PDG, INC.	0.01066	0.01411	0.02059
510	0097	U S PAINT CORPORATION	-	-	0.08453
510	0106	UNIVERSAL PRINTING CO INC	0.00257	0.00307	0.00947
510	0118	JW ALUMINUM	0.03583	0.06000	0.77336
510	0161	POLY ONE CORPORATION	-	-	0.00106
510	0162	MARQUETTE TOOL AND DIE	-	-	0.02000
510	0175	ST. LOUIS METALLIZING COMPANY			0.01000
510	0179	ITALGRANI ELEVATOR USA	0.00126	0.00150	0.00008
510	0200	ST. ALEXIUS HOSPITAL	-	-	-
510	0204	BARNES JEWISH HOSPITAL	0.02177	0.09837	0.00615
510	0269	SENSIENT COLORS LLC	0.00420	0.00507	0.00029
510	0391	HERMANN OAK LEATHER CO	-	-	0.02863
510	0405	ABLE RACK CO	-	-	0.00380
510	0468	LANGE-STEGMANN COMPANY	0.00462	0.00550	0.00031
510	0561	INDUSTRIAL CONTAINER SERVICES - MO, LLC	-	-	0.04877
510	0671	HAMMERTS IRON WORKS	-	-	-
510	0697	SIGMA - ALDRICH MFG LLC	0.02268	0.02475	0.02637
510	0746	PEPSI BEVERAGES COMPANY	0.00210	0.00250	0.00014
510	0808	CHEMISPHERE CORPORATION	-	-	0.03758
510	0809	PQ CORPORATION (THE)	0.02633	0.25462	0.01180
510	0938	INTERSTATE BRANDS CORP	0.00798	0.01130	0.19091
510	1011	MICROFINISH IPC LLC	-	-	-
510	1055	GOODWIN PRINTING CO.	-	-	0.03282

FIPS	Plant ID	Facility Site Name	CO (tons/ozone season day)	NO_X (tons/ozone season day)	VOC (tons/ozone season day)
510	1077	MID-WEST INDUSTRIAL CHEMICAL	-	-	0.01980
510	1088	SCHAEFFER MFG	-	-	0.01229
510	1093	BRENNTAG MID-SOUTH INC	-	-	0.01521
510	1123	U. S. RINGBINDER LP	-	-	0.01909
510	1216	U S POLYMERS-ACCUREZ, LLC	0.00038	0.00063	0.01316
510	1270	HUMANE SOCIETY OF MISSOURI	0.00014	0.00205	0.00578
510	1280	ST. LOUIS POST DISPATCH	0.00042	0.00050	0.00003
510	1370	NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY	0.00233	0.00502	0.00036
510	1407	SOUTHERN METAL PROCESSING	0.00610	0.01525	0.00324
510	1423	NEXEO SOLUTIONS, LLC	-	-	0.02848
510	1460	ALLIED HEALTH CARE PRODUCTS	-	-	0.00985
510	1505	ENERGY CENTER (THE)	0.01326	0.01804	0.00107
510	1518	NIES/ARTCRAFT	0.00071	0.00085	0.25041
510	1556	CONNECTOR CASTINGS	-	0.00050	0.00327
510	1642	J S ALBERICI CONSTRUCTION	-	-	0.02719
510	1761	NESTLE PURINA PETCARE COMPANY	0.07727	0.30690	0.00958
510	2111	ADVERTISERS DISPLAY AND EXHIBIT INC	-	-	0.00344
510	2300	SUPERIOR SOLVENT AND CHEMICAL	-	-	0.00902
510	2378	HERTZ ST. LOUIS ONE, LLC	0.98526	0.63879	0.00847
510	2433	NEW WORLD PASTA	0.00924	0.01100	0.00061
510	2545	SOUTHWESTERN BELL TELEPHONE COMPANY	-	-	-
510	2662	BKEP MATERIALS, LLC	0.00068	0.00080	0.00047
510	2664	TRIAD MANUFACTURING	-	-	0.10392
510	2711	ST. LOUIS UNIVERSITY	0.01638	0.01950	0.00107
510	2833	WASHINGTON UNIVERSITY	0.00252	0.00300	0.00017
510	2939	KINDER MORGAN TRANSMIX CO	0.00504	0.00600	0.03520
St. Louis City Totals			**7.36**	**4.49**	**3.59**
Grand Totals			**42.65**	**90.69**	**14.58**

Appendix A-3 2011 Area Source Emissions

The 2011 area source emissions by county for the Missouri portion of the 2008 St. Louis ozone nonattainment area are summarized below in Table A-5. The annual area source emissions were based the 2011 NEI. Documentation for the development of the 2011 NEI in Missouri is provided found in Appendix B. The emissions in Table A-5 are given in tons/ozone season day.

Details regarding the 2011 annual emissions inventory for area sources can be found in Appendix B of this document. Area source ozone season day emissions were calculated from emission modeling clearing house (EMCH) temporal allocation profiles that are SCC-specific. Ozone season day emissions are typical of a Tuesday in July. See Appendix A-7 for the temporal allocation method and table.

Table A-5 summarizes the area source emissions. Due to the methods that are used to calculate the emissions for the commercial marine and rail categories, these categories are included as area source emissions in the NEI. However, in this document these categories are classified as nonroad sources. Therefore, the emissions for rail and commercial marine sources are not included in the total area source emissions listed in Table A-5. The source classification codes for the rail and marine categories are listed in Table A-7, and the emissions from these categories are listed in Table A-18, to be included as nonroad source emissions.

Table A-5 2011 Area Source Emissions Inventory Summary for the Missouri Portion of the St. Louis Ozone Nonattainment Area (tons/ozone season day)

County Name	CO	NO_X	VOC
Franklin County	3.03	0.49	3.36
Jefferson County	8.14	0.62	7.48
St. Charles County	1.35	0.68	11.21
St. Louis County	4.72	2.65	38.68
St. Louis City	1.76	1.16	12.04
Totals	**19.01**	**5.6**	**72.77**

Table A-6 displays the 2011 area source emissions for each area source SCC for all counties in the St. Louis ozone nonattainment area, and emissions are listed in tons/ozone season day.

Table A-6 2011 Area Source Emissions by SCC in the Missouri Portion of the St. Louis Ozone Nonattainment Area (tons/ozone season day)

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29071	2102001000	-	-	-
29071	2102002000	-	-	-
29071	2102004001	0.00065109	0.00260436	0.00002604
29071	2102004002	0.01692835	0.07865169	0.00002604
29071	2102005000	0.00019938	0.00219312	0.00001117
29071	2102006000	0.08728063	0.10390532	0.00571478
29071	2102007000	0.00276066	0.00492900	0.00018012
29071	2102008000	0.05853911	0.02146432	0.00165861
29071	2102011000	0.00006221	0.00024896	0.00000245
29071	2103001000	-	-	-
29071	2103002000	-	-	-
29071	2103004001	0.00002561	0.00010243	0.00000174
29071	2103004002	0.00066581	0.00309346	0.00000174
29071	2103005000	0.00000766	0.00008428	0.00000173
29071	2103006000	0.04127141	0.04913260	0.00270230
29071	2103007000	0.00053562	0.00095632	0.00003495
29071	2103008000	0.01586826	0.00581836	0.00044960
29071	2103011000	0.00001540	0.00006191	0.00000106
29071	2104001000	-	-	-
29071	2104002000	-	-	-
29071	2104004000	0.00010197	0.00036710	0.00001428
29071	2104005000	-	-	-
29071	2104006000	0.00109833	0.00258109	0.00015102
29071	2104007000	0.02493118	0.08791523	0.00342273
29071	2104008100	0.08543520	0.00149081	0.01083708
29071	2104008210	0.05403906	0.00065559	0.01240931
29071	2104008220	0.01052131	0.00017037	0.00089670
29071	2104008230	0.00259569	0.00004973	0.00037294
29071	2104008310	0.04250494	0.00051566	0.00976065
29071	2104008320	0.00827087	0.00013393	0.00070490
29071	2104008330	0.00205373	0.00003934	0.00029508
29071	2104008400	0.00060969	0.00014571	0.00000157
29071	2104008510	0.01430807	0.00014350	0.00091958
29071	2104008610	0.03548389	0.00018149	0.00664337
29071	2104008700	0.00476583	0.00008316	0.00060452
29071	2104009000	0.00179320	0.00011016	0.00056715
29071	2104011000	0.00161684	0.00582064	0.00022636
29071	2294000000	-	-	-
29071	2296000000	-	-	-
29071	2302002100	0.00590727	-	0.00167782
29071	2302002200	0.01878814	-	0.00577278
29071	2302003000	-	-	0.00175467
29071	2302003100	0.00176568	-	0.00082712
29071	2302003200	-	-	0.00003223
29071	2306000000	0.02705168	0.01531366	0.00635429
29071	2310000220	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29071	2310000330	-	-	-
29071	2310000550	-	-	-
29071	2310000660	-	-	-
29071	2310010100	-	-	-
29071	2310010200	-	-	-
29071	2310010300	-	-	-
29071	2310011000	-	-	-
29071	2310011201	-	-	-
29071	2310011501	-	-	-
29071	2310011502	-	-	-
29071	2310011503	-	-	-
29071	2310011505	-	-	-
29071	2310021010	-	-	-
29071	2310021030	-	-	-
29071	2310021100	-	-	-
29071	2310021202	-	-	-
29071	2310021209	-	-	-
29071	2310021251	-	-	-
29071	2310021300	-	-	-
29071	2310021302	-	-	-
29071	2310021309	-	-	-
29071	2310021351	-	-	-
29071	2310021400	-	-	-
29071	2310021501	-	-	-
29071	2310021502	-	-	-
29071	2310021503	-	-	-
29071	2310021505	-	-	-
29071	2310021506	-	-	-
29071	2310021603	-	-	-
29071	2310111100	-	-	-
29071	2310111401	-	-	-
29071	2310111700	-	-	-
29071	2310121100	-	-	-
29071	2310121401	-	-	-
29071	2310121700	-	-	-
29071	2311010000	-	-	-
29071	2311020000	-	-	-
29071	2311030000	-	-	-
29071	2325000000	-	-	-
29071	2401001000	-	-	0.33250108
29071	2401005000	-	-	0.06712829
29071	2401008000	-	-	0.00064078
29071	2401015000	-	-	0.00190088
29071	2401020000	-	-	0.09282204
29071	2401025000	-	-	-
29071	2401030000	-	-	-
29071	2401055000	-	-	0.07068244
29071	2401065000	-	-	0.01283506

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29071	2401070000	-	-	0.03753027
29071	2401075000	-	-	0.00198384
29071	2401085000	-	-	-
29071	2401090000	-	-	0.02186568
29071	2401100000	-	-	0.08518882
29071	2401200000	-	-	0.00903977
29071	2415000000	-	-	0.26041724
29071	2420000000	-	-	0.00081378
29071	2425000000	-	-	0.11040604
29071	2460100000	-	-	0.26442169
29071	2460200000	-	-	0.25050505
29071	2460400000	-	-	0.18926990
29071	2460500000	-	-	0.13221071
29071	2460600000	-	-	0.07932637
29071	2460800000	-	-	0.24772145
29071	2460900000	-	-	0.00974184
29071	2461021000	-	-	0.10204574
29071	2461022000	-	-	0.05335358
29071	2461850001	-	-	0.06126745
29071	2461850002	-	-	0.00002423
29071	2461850003	-	-	0.00000110
29071	2461850004	-	-	0.00001597
29071	2461850005	-	-	0.08305866
29071	2461850006	-	-	0.01160460
29071	2461850009	-	-	0.00265993
29071	2461850051	-	-	0.00035547
29071	2461850052	-	-	0.00037314
29071	2461850053	-	-	0.00000805
29071	2461850054	-	-	0.00053851
29071	2461850055	-	-	0.00014434
29071	2461850056	-	-	0.00012626
29071	2461850099	-	-	0.00204767
29071	2501011011	-	-	0.04226469
29071	2501011012	-	-	0.08252025
29071	2501011013	-	-	0.00961821
29071	2501011014	-	-	0.00326636
29071	2501011015	-	-	0.00026893
29071	2501012011	-	-	0.00134994
29071	2501012012	-	-	0.00263571
29071	2501012013	-	-	0.01312072
29071	2501012014	-	-	0.00629500
29071	2501012015	-	-	0.00051744
29071	2501050120	-	-	0.01925845
29071	2501055120	-	-	0.01498555
29071	2501060051	-	-	-
29071	2501060052	-	-	-
29071	2501060053	-	-	0.05580918
29071	2501060101	-	-	0.05504129

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29071	2501060102	-	-	0.00614312
29071	2501060103	-	-	0.02720526
29071	2501060201	-	-	0.07894023
29071	2501070100	-	-	0.00911146
29071	2501080050	-	-	0.03158800
29071	2501080100	-	-	0.00163908
29071	2505030120	-	-	0.00516269
29071	2505040120	-	-	0.01636210
29071	2610000100	0.03937495	0.00217968	0.00984372
29071	2610000400	0.04921848	0.00175781	0.00667966
29071	2610000500	1.72144575	0.05092759	0.11814543
29071	2610030000	0.65315936	0.04610551	0.06577722
29071	2630020000	-	-	0.00524949
29071	2801000003	-	-	-
29071	2801700001	-	-	-
29071	2801700002	-	-	-
29071	2801700003	-	-	-
29071	2801700004	-	-	-
29071	2801700005	-	-	-
29071	2801700006	-	-	-
29071	2801700007	-	-	-
29071	2801700010	-	-	-
29071	2801700011	-	-	-
29071	2801700012	-	-	-
29071	2801700013	-	-	-
29071	2801700014	-	-	-
29071	2801700015	-	-	-
29071	2801700099	-	-	-
29071	2805001100	-	-	-
29071	2805001200	-	-	-
29071	2805001300	-	-	-
29071	2805002000	-	-	-
29071	2805003100	-	-	-
29071	2805007100	-	-	-
29071	2805007300	-	-	-
29071	2805009100	-	-	-
29071	2805009200	-	-	-
29071	2805009300	-	-	-
29071	2805010100	-	-	-
29071	2805010200	-	-	-
29071	2805010300	-	-	-
29071	2805018000	-	-	-
29071	2805019100	-	-	-
29071	2805019200	-	-	-
29071	2805019300	-	-	-
29071	2805021100	-	-	-
29071	2805021200	-	-	-
29071	2805021300	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29071	2805022100	-	-	-
29071	2805022200	-	-	-
29071	2805022300	-	-	-
29071	2805023100	-	-	-
29071	2805023200	-	-	-
29071	2805023300	-	-	-
29071	2805030000	-	-	-
29071	2805030007	-	-	-
29071	2805030008	-	-	-
29071	2805035000	-	-	-
29071	2805039100	-	-	-
29071	2805039200	-	-	-
29071	2805039300	-	-	-
29071	2805040000	-	-	-
29071	2805045000	-	-	-
29071	2805047100	-	-	-
29071	2805047300	-	-	-
29071	2805053100	-	-	-
29071	2810060100	0.00000027	0.00003373	0.00000027
29071	2810060200	-	-	-
Franklin County Total		**3.03**	**0.49**	**3.36**
29099	2102001000	-	-	-
29099	2102002000	-	-	-
29099	2102004001	0.00036290	0.00145161	0.00001452
29099	2102004002	0.00943542	0.04383850	0.00001452
29099	2102005000	0.00011113	0.00122239	0.00000622
29099	2102006000	0.04864802	0.05791438	0.00318528
29099	2102007000	0.00153872	0.00274730	0.00010039
29099	2102008000	0.03262832	0.01196366	0.00092447
29099	2102011000	0.00003467	0.00013877	0.00000137
29099	2103001000	-	-	-
29099	2103002000	-	-	-
29099	2103004001	0.00004011	0.00016045	0.00000273
29099	2103004002	0.00104294	0.00484567	0.00000273
29099	2103005000	0.00001200	0.00013202	0.00000271
29099	2103006000	0.06464841	0.07696255	0.00423293
29099	2103007000	0.00083901	0.00149801	0.00005474
29099	2103008000	0.02485635	0.00911401	0.00070427
29099	2103011000	0.00002412	0.00009697	0.00000166
29099	2104001000	-	-	-
29099	2104002000	-	-	-
29099	2104004000	0.00004840	0.00017426	0.00000678
29099	2104005000	-	-	-
29099	2104006000	0.00613115	0.01440821	0.00084303
29099	2104007000	0.03426766	0.12083853	0.00470451
29099	2104008100	0.18048709	0.00314944	0.02289401
29099	2104008210	0.11416064	0.00138497	0.02621535
29099	2104008220	0.02221003	0.00035965	0.00189291

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29099	2104008230	0.00548943	0.00010516	0.00078871
29099	2104008310	0.08978439	0.00108924	0.02061776
29099	2104008320	0.01747591	0.00028299	0.00148942
29099	2104008330	0.00430487	0.00008247	0.00061852
29099	2104008400	0.00127421	0.00030453	0.00000329
29099	2104008510	-	-	-
29099	2104008610	-	-	-
29099	2104008700	0.01014965	0.00017711	0.00128744
29099	2104009000	0.00373859	0.00022967	0.00118243
29099	2104011000	0.00076749	0.00276295	0.00010745
29099	2294000000	-	-	-
29099	2296000000	-	-	-
29099	2302002100	0.01273118	-	0.00361600
29099	2302002200	0.04049168	-	0.01244136
29099	2302003000	-	-	0.00378161
29099	2302003100	0.00380536	-	0.00178259
29099	2302003200	-	-	0.00006945
29099	2306000000	0.01271517	0.00590371	0.00145762
29099	2310000220	-	-	-
29099	2310000330	-	-	-
29099	2310000550	-	-	-
29099	2310000660	-	-	-
29099	2310010100	-	-	-
29099	2310010200	-	-	-
29099	2310010300	-	-	-
29099	2310011000	-	-	-
29099	2310011201	-	-	-
29099	2310011501	-	-	-
29099	2310011502	-	-	-
29099	2310011503	-	-	-
29099	2310011505	-	-	-
29099	2310021010	-	-	-
29099	2310021030	-	-	-
29099	2310021100	-	-	-
29099	2310021202	-	-	-
29099	2310021209	-	-	-
29099	2310021251	-	-	-
29099	2310021300	-	-	-
29099	2310021302	-	-	-
29099	2310021309	-	-	-
29099	2310021351	-	-	-
29099	2310021400	-	-	-
29099	2310021501	-	-	-
29099	2310021502	-	-	-
29099	2310021503	-	-	-
29099	2310021505	-	-	-
29099	2310021506	-	-	-
29099	2310021603	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29099	2310111100	-	-	-
29099	2310111401	-	-	-
29099	2310111700	-	-	-
29099	2310121100	-	-	-
29099	2310121401	-	-	-
29099	2310121700	-	-	-
29099	2311010000	-	-	-
29099	2311020000	-	-	-
29099	2311030000	-	-	-
29099	2325000000	-	-	-
29099	2401001000	-	-	0.71659848
29099	2401005000	-	-	0.09971866
29099	2401008000	-	-	0.00061183
29099	2401015000	-	-	0.00059636
29099	2401020000	-	-	0.06536062
29099	2401030000	-	-	-
29099	2401040000	-	-	-
29099	2401055000	-	-	0.00385821
29099	2401060000	-	-	0.00094264
29099	2401070000	-	-	0.00670343
29099	2401075000	-	-	0.00068017
29099	2401080000	-	-	0.00231385
29099	2401085000	-	-	-
29099	2401090000	-	-	0.03318437
29099	2401100000	-	-	0.18359711
29099	2401200000	-	-	0.01948226
29099	2415000000	-	-	0.17574452
29099	2420000000	-	-	0.00429678
29099	2425000000	-	-	0.01696415
29099	2460100000	-	-	0.56987479
29099	2460200000	-	-	0.53988044
29099	2460400000	-	-	0.40791024
29099	2460500000	-	-	0.28493671
29099	2460600000	-	-	0.17096257
29099	2460800000	-	-	0.53388266
29099	2460900000	-	-	0.02099536
29099	2461021000	-	-	0.18497901
29099	2461022000	-	-	0.09671446
29099	2461850001	-	-	0.01266586
29099	2461850002	-	-	0.00001304
29099	2461850003	-	-	0.00000039
29099	2461850004	-	-	0.00001065
29099	2461850005	-	-	0.01875520
29099	2461850006	-	-	0.00424734
29099	2461850009	-	-	0.00035986
29099	2461850051	-	-	0.00007349
29099	2461850052	-	-	0.00020092
29099	2461850053	-	-	0.00000288

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29099	2461850054	-	-	0.00035900
29099	2461850055	-	-	0.00003259
29099	2461850056	-	-	0.00002844
29099	2461850099	-	-	0.00065704
29099	2501011011	-	-	0.09220252
29099	2501011012	-	-	0.18002203
29099	2501011013	-	-	0.02098263
29099	2501011014	-	-	0.00712572
29099	2501011015	-	-	0.00058668
29099	2501012011	-	-	0.00294497
29099	2501012012	-	-	0.00574994
29099	2501012013	-	-	0.02862366
29099	2501012014	-	-	0.01373284
29099	2501012015	-	-	0.00112882
29099	2501050120	-	-	0.21850815
29099	2501055120	-	-	0.17002739
29099	2501060051	-	-	-
29099	2501060052	-	-	1.42813356
29099	2501060053	-	-	-
29099	2501060101	-	-	0.05317641
29099	2501060102	-	-	0.00959863
29099	2501060103	-	-	0.04220655
29099	2501060201	-	-	0.13931370
29099	2501070100	-	-	0.01080307
29099	2501080050	-	-	0.00430592
29099	2501080100	-	-	0.00022343
29099	2505030120	-	-	0.00911113
29099	2505040120	-	-	0.18564601
29099	2610000100	0.04608823	0.00255132	0.01152206
29099	2610000400	0.05761043	0.00205751	0.00781855
29099	2610000500	6.52981096	0.19323414	0.44831088
29099	2610030000	0.76452541	0.05396652	0.07699226
29099	2630020000	-	-	0.01132531
29099	2801000003	-	-	-
29099	2801700001	-	-	-
29099	2801700002	-	-	-
29099	2801700003	-	-	-
29099	2801700004	-	-	-
29099	2801700005	-	-	-
29099	2801700006	-	-	-
29099	2801700007	-	-	-
29099	2801700010	-	-	-
29099	2801700011	-	-	-
29099	2801700012	-	-	-
29099	2801700013	-	-	-
29099	2801700014	-	-	-
29099	2801700015	-	-	-
29099	2801700099	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29099	2805001100	-	-	-
29099	2805001200	-	-	-
29099	2805001300	-	-	-
29099	2805002000	-	-	-
29099	2805003100	-	-	-
29099	2805007100	-	-	-
29099	2805007300	-	-	-
29099	2805009100	-	-	-
29099	2805009200	-	-	-
29099	2805009300	-	-	-
29099	2805010100	-	-	-
29099	2805010200	-	-	-
29099	2805010300	-	-	-
29099	2805018000	-	-	-
29099	2805019100	-	-	-
29099	2805019200	-	-	-
29099	2805019300	-	-	-
29099	2805021100	-	-	-
29099	2805021200	-	-	-
29099	2805021300	-	-	-
29099	2805022100	-	-	-
29099	2805022200	-	-	-
29099	2805022300	-	-	-
29099	2805023100	-	-	-
29099	2805023200	-	-	-
29099	2805023300	-	-	-
29099	2805030000	-	-	-
29099	2805030007	-	-	-
29099	2805030008	-	-	-
29099	2805035000	-	-	-
29099	2805039100	-	-	-
29099	2805039200	-	-	-
29099	2805039300	-	-	-
29099	2805040000	-	-	-
29099	2805045000	-	-	-
29099	2805047100	-	-	-
29099	2805047300	-	-	-
29099	2805053100	-	-	-
29099	2810060100	-	-	-
29099	2810060200	0.00102184	0.00438520	0.00438520
Jefferson County Total		**8.14**	**0.62**	**7.48**
29183	2102001000	-	-	-
29183	2102002000	-	-	-
29183	2102004001	0.00084377	0.00337509	0.00003375
29183	2102004002	0.02193800	0.10192738	0.00003375
29183	2102005000	0.00025838	0.00284215	0.00001447
29183	2102006000	0.11310965	0.13465438	0.00740601
29183	2102007000	0.00357762	0.00638767	0.00023342

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29183	2102008000	0.07586267	0.02781632	0.00214944
29183	2102011000	0.00008062	0.00032264	0.00000318
29183	2103001000	-	-	-
29183	2103002000	-	-	-
29183	2103004001	0.00011374	0.00045497	0.00000773
29183	2103004002	0.00295728	0.01373998	0.00000773
29183	2103005000	0.00003403	0.00037434	0.00000769
29183	2103006000	0.18331261	0.21822809	0.01200257
29183	2103007000	0.00237903	0.00424763	0.00015522
29183	2103008000	0.07048081	0.02584297	0.00199696
29183	2103011000	0.00006838	0.00027496	0.00000470
29183	2104001000	-	-	-
29183	2104002000	-	-	-
29183	2104004000	0.00002513	0.00009047	0.00000352
29183	2104005000	-	-	-
29183	2104006000	0.01923700	0.04520700	0.00264510
29183	2104007000	0.02032828	0.07168394	0.00279082
29183	2104008100	0.29217606	0.00509839	0.03706139
29183	2104008210	0.18475023	0.00224133	0.04242529
29183	2104008220	0.03594174	0.00058201	0.00306322
29183	2104008230	0.00887858	0.00017009	0.00127566
29183	2104008310	0.14537138	0.00176360	0.03338254
29183	2104008320	0.02828517	0.00045803	0.00241066
29183	2104008330	0.00698619	0.00013384	0.00100376
29183	2104008400	0.00203926	0.00048737	0.00000526
29183	2104008510	-	-	-
29183	2104008610	-	-	-
29183	2104008700	0.01615356	0.00028187	0.00204901
29183	2104009000	0.00614573	0.00037755	0.00194377
29183	2104011000	0.00039845	0.00143444	0.00005578
29183	2294000000	-	-	-
29183	2296000000	-	-	-
29183	2302002100	0.02098176	-	0.00595941
29183	2302002200	0.06673269	-	0.02050407
29183	2302003000	-	-	0.00623231
29183	2302003100	0.00627147	-	0.00293781
29183	2302003200	-	-	0.00011446
29183	2306000000	0.01533395	0.00609568	0.00198253
29183	2310000220	-	-	-
29183	2310000330	-	-	-
29183	2310000550	-	-	-
29183	2310000660	-	-	-
29183	2310010100	-	-	-
29183	2310010200	-	-	-
29183	2310010300	-	-	-
29183	2310011000	-	-	-
29183	2310011201	-	-	-
29183	2310011501	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29183	2310011502	-	-	-
29183	2310011503	-	-	-
29183	2310011505	-	-	-
29183	2310021010	-	-	-
29183	2310021030	-	-	-
29183	2310021100	-	-	-
29183	2310021202	-	-	-
29183	2310021209	-	-	-
29183	2310021251	-	-	-
29183	2310021300	-	-	-
29183	2310021302	-	-	-
29183	2310021309	-	-	-
29183	2310021351	-	-	-
29183	2310021400	-	-	-
29183	2310021501	-	-	-
29183	2310021502	-	-	-
29183	2310021503	-	-	-
29183	2310021505	-	-	-
29183	2310021506	-	-	-
29183	2310021603	-	-	-
29183	2310111100	-	-	-
29183	2310111401	-	-	-
29183	2310111700	-	-	-
29183	2310121100	-	-	-
29183	2310121401	-	-	-
29183	2310121700	-	-	-
29183	2311010000	-	-	-
29183	2311020000	-	-	-
29183	2311030000	-	-	-
29183	2325000000	-	-	-
29183	2401001000	-	-	1.18099758
29183	2401005000	-	-	0.22151033
29183	2401008000	-	-	0.00077953
29183	2401015000	-	-	0.00059636
29183	2401020000	-	-	0.01595372
29183	2401025000	-	-	0.00364055
29183	2401030000	-	-	0.09965696
29183	2401055000	-	-	0.07616394
29183	2401070000	-	-	-
29183	2401075000	-	-	-
29183	2401080000	-	-	0.00231385
29183	2401085000	-	-	-
29183	2401090000	-	-	0.07572875
29183	2401100000	-	-	0.30257903
29183	2401200000	-	-	0.03210789
29183	2415000000	-	-	0.43155441
29183	2420000000	-	-	0.02447861
29183	2425000000	-	-	0.22891297

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29183	2460100000	-	-	0.93918756
29183	2460200000	-	-	0.88975599
29183	2460400000	-	-	0.67226063
29183	2460500000	-	-	0.46959378
29183	2460600000	-	-	0.28175545
29183	2460800000	-	-	0.87986940
29183	2460900000	-	-	0.03460169
29183	2461021000	-	-	0.20566873
29183	2461022000	-	-	0.10753179
29183	2461850001	-	-	0.12430224
29183	2461850002	-	-	0.00002153
29183	2461850003	-	-	0.00000164
29183	2461850004	-	-	0.00029907
29183	2461850005	-	-	0.14944619
29183	2461850006	-	-	0.00653914
29183	2461850009	-	-	0.00114552
29183	2461850051	-	-	0.00072120
29183	2461850052	-	-	0.00033166
29183	2461850053	-	-	0.00001196
29183	2461850054	-	-	0.01008191
29183	2461850055	-	-	0.00025972
29183	2461850056	-	-	0.00016288
29183	2461850099	-	-	0.00126899
29183	2501011011	-	-	0.18524808
29183	2501011012	-	-	0.36169010
29183	2501011013	-	-	0.04215718
29183	2501011014	-	-	0.01431663
29183	2501011015	-	-	0.00117873
29183	2501012011	-	-	0.00591687
29183	2501012012	-	-	0.01155247
29183	2501012013	-	-	0.05750896
29183	2501012014	-	-	0.02759140
29183	2501012015	-	-	0.00226797
29183	2501050120	-	-	0.11228889
29183	2501060051	-	-	-
29183	2501060052	-	-	2.18074843
29183	2501060053	-	-	-
29183	2501060101	-	-	0.01963606
29183	2501060102	-	-	0.01598858
29183	2501060103	-	-	0.07182518
29183	2501060201	-	-	0.21273088
29183	2501070100	-	-	0.01623079
29183	2501080050	-	-	0.07349534
29183	2501080100	-	-	0.00381362
29183	2505030120	-	-	0.01391258
29183	2505040120	-	-	0.09540133
29183	2610000500	-	-	-
29183	2630020000	-	-	0.01817882

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29183	2801000003	-	-	-
29183	2801700001	-	-	-
29183	2801700002	-	-	-
29183	2801700003	-	-	-
29183	2801700004	-	-	-
29183	2801700005	-	-	-
29183	2801700006	-	-	-
29183	2801700007	-	-	-
29183	2801700010	-	-	-
29183	2801700011	-	-	-
29183	2801700012	-	-	-
29183	2801700013	-	-	-
29183	2801700014	-	-	-
29183	2801700015	-	-	-
29183	2801700099	-	-	-
29183	2805001100	-	-	-
29183	2805001200	-	-	-
29183	2805001300	-	-	-
29183	2805002000	-	-	-
29183	2805003100	-	-	-
29183	2805007100	-	-	-
29183	2805007300	-	-	-
29183	2805018000	-	-	-
29183	2805019100	-	-	-
29183	2805019200	-	-	-
29183	2805019300	-	-	-
29183	2805021100	-	-	-
29183	2805021200	-	-	-
29183	2805021300	-	-	-
29183	2805022100	-	-	-
29183	2805022200	-	-	-
29183	2805022300	-	-	-
29183	2805023100	-	-	-
29183	2805023200	-	-	-
29183	2805023300	-	-	-
29183	2805030000	-	-	-
29183	2805030007	-	-	-
29183	2805030008	-	-	-
29183	2805035000	-	-	-
29183	2805039100	-	-	-
29183	2805039200	-	-	-
29183	2805039300	-	-	-
29183	2805040000	-	-	-
29183	2805045000	-	-	-
29183	2805047100	-	-	-
29183	2805047300	-	-	-
29183	2805053100	-	-	-
29183	2810060100	0.00055535	0.00067081	0.00001264

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29183	2810060200	0.00050489	0.00061952	0.00175573
St. Charles County Total		**1.35**	**0.68**	**11.21**
29189	2102001000	-	-	-
29189	2102002000	-	-	-
29189	2102004001	0.00311153	0.01244614	0.00012446
29189	2102004002	0.08089970	0.37587256	0.00012446
29189	2102005000	0.00095280	0.01048083	0.00005336
29189	2102006000	0.41710867	0.49655875	0.02731076
29189	2102007000	0.01319308	0.02355550	0.00086078
29189	2102008000	0.27975550	0.10257692	0.00792640
29189	2102011000	0.00029729	0.00118978	0.00001172
29189	2103001000	-	-	-
29189	2103002000	-	-	-
29189	2103004001	0.00054974	0.00219896	0.00003738
29189	2103004002	0.01429318	0.06640832	0.00003738
29189	2103005000	0.00016448	0.00180927	0.00003717
29189	2103006000	0.88598724	1.05474511	0.05801107
29189	2103007000	0.01149836	0.02052971	0.00075021
29189	2103008000	0.34064815	0.12490449	0.00965171
29189	2103011000	0.00033052	0.00132896	0.00002272
29189	2104001000	-	-	-
29189	2104002000	-	-	-
29189	2104004000	0.00004203	0.00015131	0.00000588
29189	2104005000	-	-	-
29189	2104006000	0.09277417	0.21801946	0.01275646
29189	2104007000	0.01388132	0.04895000	0.00190573
29189	2104008100	0.86590811	0.01510980	0.10983658
29189	2104008210	0.54757352	0.00664301	0.12574271
29189	2104008220	0.10655547	0.00172547	0.00908144
29189	2104008230	0.02632685	0.00050435	0.00378260
29189	2104008310	0.43080196	0.00522637	0.09892764
29189	2104008320	0.08384079	0.00135765	0.00714552
29189	2104008330	0.02073140	0.00039715	0.00297865
29189	2104008400	0.00641284	0.00153263	0.00001654
29189	2104008510	-	-	-
29189	2104008610	-	-	-
29189	2104008700	0.04716465	0.00082301	0.00598263
29189	2104009000	0.01852741	0.00113819	0.00585980
29189	2104011000	0.00066644	0.00239917	0.00009330
29189	2294000000	-	-	-
29189	2296000000	-	-	-
29189	2302002100	0.05814329	-	0.01651431
29189	2302002200	0.18492584	-	0.05681978
29189	2302003000	-	-	0.01727062
29189	2302003100	0.01737909	-	0.00814109
29189	2302003200	-	-	0.00031720
29189	2306000000	0.14881113	0.05267317	0.02399685
29189	2310000220	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29189	2310000330	-	-	-
29189	2310000550	-	-	-
29189	2310000660	-	-	-
29189	2310010100	-	-	-
29189	2310010200	-	-	-
29189	2310010300	-	-	-
29189	2310011000	-	-	-
29189	2310011201	-	-	-
29189	2310011501	-	-	-
29189	2310011502	-	-	-
29189	2310011503	-	-	-
29189	2310011505	-	-	-
29189	2310021010	-	-	-
29189	2310021030	-	-	-
29189	2310021100	-	-	-
29189	2310021202	-	-	-
29189	2310021209	-	-	-
29189	2310021251	-	-	-
29189	2310021300	-	-	-
29189	2310021302	-	-	-
29189	2310021309	-	-	-
29189	2310021351	-	-	-
29189	2310021400	-	-	-
29189	2310021501	-	-	-
29189	2310021502	-	-	-
29189	2310021503	-	-	-
29189	2310021505	-	-	-
29189	2310021506	-	-	-
29189	2310021603	-	-	-
29189	2310111100	-	-	-
29189	2310111401	-	-	-
29189	2310111700	-	-	-
29189	2310121100	-	-	-
29189	2310121401	-	-	-
29189	2310121700	-	-	-
29189	2311010000	-	-	-
29189	2311020000	-	-	-
29189	2311030000	-	-	-
29189	2325000000	-	-	-
29189	2401001000	-	-	3.27270462
29189	2401005000	-	-	1.04964312
29189	2401008000	-	-	0.00193489
29189	2401015000	-	-	0.01072641
29189	2401020000	-	-	0.31916569
29189	2401025000	-	-	0.20346329
29189	2401030000	-	-	0.04637228
29189	2401040000	-	-	-
29189	2401055000	-	-	0.18024117

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29189	2401065000	-	-	0.00080802
29189	2401070000	-	-	0.05329055
29189	2401075000	-	-	-
29189	2401085000	-	-	-
29189	2401090000	-	-	0.33588935
29189	2401100000	-	-	0.83848754
29189	2401200000	-	-	0.08897563
29189	2415000000	-	-	1.23471659
29189	2420000000	-	-	0.13137720
29189	2425000000	-	-	1.00894989
29189	2460100000	-	-	2.60261371
29189	2460200000	-	-	2.46564126
29189	2460400000	-	-	1.86292956
29189	2460500000	-	-	1.30130823
29189	2460600000	-	-	0.78078549
29189	2460800000	-	-	2.43824403
29189	2460900000	-	-	0.09588593
29189	2461021000	-	-	0.87810154
29189	2461022000	-	-	0.45910650
29189	2461850001	-	-	0.01119310
29189	2461850002	-	-	0.00000430
29189	2461850003	-	-	0.00000003
29189	2461850004	-	-	0.00003822
29189	2461850005	-	-	0.02113680
29189	2461850006	-	-	0.00175799
29189	2461850009	-	-	0.00017836
29189	2461850051	-	-	0.00006494
29189	2461850052	-	-	0.00006621
29189	2461850053	-	-	0.00000020
29189	2461850054	-	-	0.00128831
29189	2461850055	-	-	0.00003673
29189	2461850056	-	-	0.00004738
29189	2461850099	-	-	0.00083307
29189	2501011011	-	-	1.06166334
29189	2501011012	-	-	2.07286257
29189	2501011013	-	-	0.24160438
29189	2501011014	-	-	0.08204937
29189	2501011015	-	-	0.00675532
29189	2501012011	-	-	0.03390977
29189	2501012012	-	-	0.06620779
29189	2501012013	-	-	0.32958679
29189	2501012014	-	-	0.15812674
29189	2501012015	-	-	0.01299781
29189	2501055120	-	-	0.45104512
29189	2501060051	-	-	-
29189	2501060052	-	-	9.79584085
29189	2501060053	-	-	-
29189	2501060101	-	-	0.03406143

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29189	2501060102	-	-	0.05246337
29189	2501060103	-	-	0.23228685
29189	2501060201	-	-	0.95557928
29189	2501070100	-	-	0.07193460
29189	2501080050	-	-	0.15149491
29189	2501080100	-	-	0.00786098
29189	2505030120	-	-	0.06249476
29189	2505040120	-	-	0.49247829
29189	2610000500	-	-	-
29189	2801000003	-	-	-
29189	2801700001	-	-	-
29189	2801700002	-	-	-
29189	2801700003	-	-	-
29189	2801700004	-	-	-
29189	2801700005	-	-	-
29189	2801700006	-	-	-
29189	2801700007	-	-	-
29189	2801700010	-	-	-
29189	2801700011	-	-	-
29189	2801700012	-	-	-
29189	2801700013	-	-	-
29189	2801700014	-	-	-
29189	2801700015	-	-	-
29189	2801700099	-	-	-
29189	2805001100	-	-	-
29189	2805001200	-	-	-
29189	2805001300	-	-	-
29189	2805002000	-	-	-
29189	2805007100	-	-	-
29189	2805007300	-	-	-
29189	2805010100	-	-	-
29189	2805010200	-	-	-
29189	2805010300	-	-	-
29189	2805030008	-	-	-
29189	2805035000	-	-	-
29189	2805039100	-	-	-
29189	2805039200	-	-	-
29189	2805039300	-	-	-
29189	2805045000	-	-	-
29189	2805047100	-	-	-
29189	2805047300	-	-	-
29189	2805053100	-	-	-
29189	2810060100	0.00047445	0.00057290	0.00004690
29189	2810060200	0.00011793	0.00014261	0.00001179
St. Louis County Total		**4.72**	**2.65**	**38.68**
29510	2102001000	-	-	-
29510	2102002000	-	-	-
29510	2102004001	0.00151400	0.00605599	0.00006056

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29510	2102004002	0.03936390	0.18289080	0.00006056
29510	2102005000	0.00046361	0.00509972	0.00002596
29510	2102006000	0.20295573	0.24161371	0.01328876
29510	2102007000	0.00641944	0.01146154	0.00041883
29510	2102008000	0.13612232	0.04991158	0.00385681
29510	2102011000	0.00014466	0.00057892	0.00000570
29510	2103001000	-	-	-
29510	2103002000	-	-	-
29510	2103004001	0.00023524	0.00094095	0.00001600
29510	2103004002	0.00611618	0.02841664	0.00001600
29510	2103005000	0.00007038	0.00077420	0.00001591
29510	2103006000	0.37912104	0.45133433	0.02482333
29510	2103007000	0.00492026	0.00878484	0.00032102
29510	2103008000	0.14576641	0.05344772	0.00413005
29510	2103011000	0.00014143	0.00056867	0.00000972
29510	2104001000	-	-	-
29510	2104002000	-	-	-
29510	2104004000	0.00003364	0.00012111	0.00000471
29510	2104005000	-	-	-
29510	2104006000	0.03397340	0.07983745	0.00467134
29510	2104007000	0.00702414	0.02476935	0.00096433
29510	2104008100	0.28701628	0.00500833	0.03640664
29510	2104008210	0.18152988	0.00220227	0.04168564
29510	2104008220	0.03531524	0.00057187	0.00300983
29510	2104008230	0.00873291	0.00016730	0.00125473
29510	2104008310	0.14282039	0.00173266	0.03279677
29510	2104008320	0.02781386	0.00045040	0.00237051
29510	2104008330	0.00687006	0.00013161	0.00098708
29510	2104008400	0.00232518	0.00055570	0.00000600
29510	2104008510	-	-	-
29510	2104008610	-	-	-
29510	2104008700	0.01477276	0.00025778	0.00187386
29510	2104009000	0.00650068	0.00039935	0.00205601
29510	2104011000	0.00053340	0.00192026	0.00007468
29510	2294000000	-	-	-
29510	2296000000	-	-	-
29510	2302002100	0.01858426	-	0.00527845
29510	2302002200	0.05910754	-	0.01816118
29510	2302003000	-	-	0.00552017
29510	2302003100	0.00555484	-	0.00260213
29510	2302003200	-	-	0.00010139
29510	2310000220	-	-	-
29510	2310000330	-	-	-
29510	2310000550	-	-	-
29510	2310000660	-	-	-
29510	2310010100	-	-	-
29510	2310010200	-	-	-
29510	2310010300	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29510	2310011000	-	-	-
29510	2310011201	-	-	-
29510	2310011501	-	-	-
29510	2310011502	-	-	-
29510	2310011503	-	-	-
29510	2310011505	-	-	-
29510	2310021010	-	-	-
29510	2310021030	-	-	-
29510	2310021100	-	-	-
29510	2310021202	-	-	-
29510	2310021209	-	-	-
29510	2310021251	-	-	-
29510	2310021300	-	-	-
29510	2310021302	-	-	-
29510	2310021309	-	-	-
29510	2310021351	-	-	-
29510	2310021400	-	-	-
29510	2310021501	-	-	-
29510	2310021502	-	-	-
29510	2310021503	-	-	-
29510	2310021505	-	-	-
29510	2310021506	-	-	-
29510	2310021603	-	-	-
29510	2310111100	-	-	-
29510	2310111401	-	-	-
29510	2310111700	-	-	-
29510	2310121100	-	-	-
29510	2310121401	-	-	-
29510	2310121700	-	-	-
29510	2311010000	-	-	-
29510	2311020000	-	-	-
29510	2311030000	-	-	-
29510	2325000000	-	-	-
29510	2401001000	-	-	1.04605023
29510	2401005000	-	-	0.09662132
29510	2401008000	-	-	0.00045771
29510	2401015000	-	-	0.01025119
29510	2401020000	-	-	0.27436655
29510	2401025000	-	-	0.14408253
29510	2401030000	-	-	0.00066412
29510	2401055000	-	-	0.03977631
29510	2401065000	-	-	0.01283506
29510	2401070000	-	-	0.01916638
29510	2401075000	-	-	0.00011336
29510	2401080000	-	-	0.04647287
29510	2401085000	-	-	-
29510	2401090000	-	-	0.12411979
29510	2401100000	-	-	0.26800366

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29510	2401200000	-	-	0.02843909
29510	2415000000	-	-	0.66642649
29510	2420000000	-	-	0.03554606
29510	2425000000	-	-	0.35986250
29510	2460100000	-	-	0.83187077
29510	2460200000	-	-	0.78808730
29510	2460400000	-	-	0.59544416
29510	2460500000	-	-	0.41593470
29510	2460600000	-	-	0.24956164
29510	2460800000	-	-	0.77933061
29510	2460900000	-	-	0.03064788
29510	2461021000	-	-	0.31800595
29510	2461022000	-	-	0.16626630
29510	2501011011	-	-	0.16442673
29510	2501011012	-	-	0.32103853
29510	2501011013	-	-	0.03741875
29510	2501011014	-	-	0.01270749
29510	2501011015	-	-	0.00104624
29510	2501012011	-	-	0.00525182
29510	2501012012	-	-	0.01025400
29510	2501012013	-	-	0.05104497
29510	2501012014	-	-	0.02449008
29510	2501012015	-	-	0.00201305
29510	2501055120	-	-	0.46757670
29510	2501060051	-	-	-
29510	2501060052	-	-	2.50389866
29510	2501060053	-	-	-
29510	2501060101	-	-	0.00778860
29510	2501060102	-	-	0.01349293
29510	2501060103	-	-	0.05942923
29510	2501060201	-	-	0.24425415
29510	2501070100	-	-	0.02114784
29510	2501080050	-	-	0.00199212
29510	2501080100	-	-	0.00010337
29510	2505030120	-	-	0.01597421
29510	2505040120	-	-	0.51052646
29510	2610000500	-	-	-
29510	2801000003	-	-	-
29510	2801700001	-	-	-
29510	2801700002	-	-	-
29510	2801700003	-	-	-
29510	2801700004	-	-	-
29510	2801700005	-	-	-
29510	2801700006	-	-	-
29510	2801700007	-	-	-
29510	2801700010	-	-	-
29510	2801700011	-	-	-
29510	2801700012	-	-	-

County FIPS	SCC	2011 CO Emissions (tons/ozone season day)	2011 NO_X Emissions (tons/ozone season day)	2011 VOC Emissions (tons/ozone season day)
29510	2801700013	-	-	-
29510	2801700014	-	-	-
29510	2801700015	-	-	-
29510	2801700099	-	-	-
29510	2810060100	0.00029125	0.00035131	0.00002934
29510	2810060200	0.00013438	0.00261330	0.00532313
St. Louis City Total		**1.76**	**1.16**	**12.04**
Grand Total		**19.01**	**5.60**	**72.77**

Table A-7 SCC Codes and Descriptions for Commercial Marine, Aircraft, and Rail Categories Not Included in the Total Area Source Emissions

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2280002100	Mobile Sources	Diesel	Marine Vessels, Commercial	Port emissions
2280002200	Mobile Sources	Diesel	Marine Vessels, Commercial	Underway emissions
2285002006	Mobile Sources	Diesel	Railroad Equipment	Line Haul Locomotives: Class I Operations
2285002007	Mobile Sources	Diesel	Railroad Equipment	Line Haul Locomotives: Class II / III Operations
28500201	Internal Combustion Engines	Railroad Equipment	Diesel	Yard Locomotives
2275001000	Mobile Sources	Military Aircraft	Aircraft	Total
2275020000	Mobile Sources	Commercial Aircraft	Aircraft	Total: All Types
2275050011	Mobile Sources	General Aviation	Aircraft	Piston
2275050012	Mobile Sources	General Aviation	Aircraft	Turbine
2275060011	Mobile Sources	Air Taxi	Aircraft	Piston
2275060012	Mobile Sources	Air Taxi	Aircraft	Turbine
2275070000	Mobile Sources	Aircraft Auxiliary Power Units	Aircraft	Total

Appendix A-4 2011 Onroad Mobile Source Emissions

Onroad mobile source emissions were estimated using EPA's MOVES model. The Air Program updated the MOVES county input databases for the St. Louis nonattainment area counties with local activity data. These updates more accurately reflect Missouri emissions than the data in the 2011 County Databases provided by EPA. The Air Program updated the following Input Tables using local activity data.

hpmsvtypeyear (VMT data): This table was updated for all five nonattainment area counties. Vehicle miles traveled (VMT) data by county for the State of Missouri was provided by the Missouri Department of Transportation (MoDOT). This county data for the St. Louis nonattainment area was also provided to, and used by, the East/West Gateway Council of Governments, the St. Louis metro area's designated planning organization for Transportation Conformity Purposes. The VMT was distributed to the Vehicle Source Type using a Statewide VMT-Vehicle distribution provided by MoDOT.

roadtypedistribution: This table was updated for all five nonattainment area counties. VMT distribution by road type for the State of Missouri was provided by MoDOT. The same MOVES road type distribution table was used for each county in MoDOT's St. Louis District, which includes all of the St. Louis nonattainment area counties.

sourcetypeagedistribution: This table was updated for all five nonattainment area counties. A list of Vehicle Identification Numbers (VINs), by county, was provided by the Missouri Department of Revenue (DOR). The VINs were decoded into model year and MOBILE6 vehicle classes by ESP Data Solutions, Inc, a private contractor. One specific age distribution input was created to be used for all five nonattainment area counties. This age distribution input was converted to the MOVES format using the EPA provided Mobile6 to MOVES conversion excel workbook.

sourcetypeyear (vehicle populations): This table was updated for all five nonattainment area counties. A list of Vehicle Identification Numbers (VINs), by county, was provided by the DOR. The VINs were decoded into model year and MOBILE6 vehicle classes by ESP Data Solutions, Inc, a private contractor. Mobile6 vehicle population counts were created for each county. These county vehicle populations were converted to the MOVES format using the EPA provided Mobile6 to MOVES conversion excel workbook.

imcoverage: This table was updated for all five nonattainment area counties. IM data was provided by the Air Program's I/M Program. The Air Program used EPA technical guidance on appropriate input assumptions and sources of data for the use of MOVES 2010 in State Implementation Plan (http://www.epa.gov/otaq/models/moves/420b10023.pdf). Section 3.10 of this guidance document explains the appropriate assumptions and methods to be used when developing the I/M input table for MOVES 2010. This guidance was followed in the development of the I/M input tables. The following outlines the approach used to develop each parameter of these I/M input tables in MOVES.

Pollutant Process ID

To begin development of the I/M input table, the default data for the I/M input table for St. Louis County was exported from the MOVES county database manager. The default data included four different I/M test types. However, the actual St. Louis area only had two different test types (On-board diagnostics) OBD tests for the exhaust and evaporative systems. In the default I/M input table, these were the only two types of tests that were "turned on" along with the appropriate pollutant process IDs that would be impacted by each test. Therefore, the pollutant process IDs that were included in the default table for the two OBD tests were the same pollutant process IDs used in the I/M input table for the St. Louis nonattainment area. The other two tests included in the default data along with their associated pollutant process IDs were still included in the I/M input table, but they were "turned off".

Source Type ID

The St. Louis I/M program includes passenger cars and also trucks with a gross vehicle weight rating of 8,500 lbs. or less. Therefore, the three source type IDs included in the I/M input table for the St. Louis nonattainment area are passenger cars, passenger trucks, and light commercial trucks (IDs = 21, 31, and 32).

Inspection Frequency

The St. Louis I/M program requires that emission be tested every two years, so the inspection frequency ID that represents biennial tests (ID = 2) was used in the I/M input table for the OBD tests applicable to the St. Louis nonattainment area.

Test Standards

The St. Louis I/M program is a centralized program with OBD tests for exhaust and evaporative systems on the vehicles. Therefore, the test standard IDs for exhaust OBD check and the evaporative system OBD check (IDs = 43 and 51) were used in the I/M input table for the St. Louis nonattainment area.

I/M Program ID

This is an arbitrary number developed by the MOVES user to define a unique test given for vehicles within a range of model years. Therefore, I/M program IDs were arbitrarily assigned to the various unique tests within the St. Louis I/M program.

Beginning and Ending Model Years

The St. Louis I/M program applies to gasoline vehicles with a model year of 1996 or later and it also applies to diesel vehicles with a model year of 1997 or later. Since the emissions inspection is required biennially, the ending model year would always be two years less than the emissions inventory year that is being developed. Therefore, for the tests for gasoline vehicles, the beginning model year is 1996 and the ending model year is two years earlier than the year for which MOVES is being run, and the for diesel vehicles the beginning model year is 1997 and the ending model year is two years earlier than the year for which MOVES is being run.

Compliance Factor

According to page 39 of the MOVES guidance document the compliance factor is calculated with the following equation:

Compliance Factor = percent compliance rate x (100 – percent waiver rate) x regulatory class coverage adjustment.

Therefore, in order to calculate the compliance factor for each source type included in the I/M program, the compliance rate, waiver rate, and regulatory class coverage adjustment needed to be determined. These three values were determined by the processes described below and then the compliance factors for each source type were calculated with the equation written above.

Compliance Rate

The compliance rate was calculated with the following equation:

Compliance Rate = Number of vehicles that were tested over a two year period (2010 – 2011) / Population of vehicles that is theoretically subject to I/M during the same period.

In order to determine the compliance rate, as it compares to the source type population by model year, the population of vehicles that is theoretically subject to I/M first needed to be determined. In May 2012, the Missouri Department of Revenue (DOR) Vehicle Registration database was queried and a VIN decoder was used to separate the vehicle counts into Mobile 6.2 vehicle classes by model year. In the St. Louis nonattainment area, the Mobile 6.2 vehicle classes that are subject to I/M include 1996 and newer light duty gasoline vehicles, light duty gasoline trucks Class 1, light duty gasoline trucks Class 2, light duty gasoline trucks Class 3, light duty gasoline trucks Class 4, as well as 1997 and newer light duty diesel vehicles, light duty diesel trucks Class 1, light duty diesel trucks Class 2, light duty diesel trucks Class 3, and light duty diesel trucks Class 4. Table A-8 shows the total combined population of these 10 vehicle classes within the appropriate model years by county in the St. Louis nonattainment area according to the May 2012 DOR data.

Table A-8 Vehicles Theoretically Subject to the I/M Program in the St. Louis Nonattainment Area

County	Light Duty Gas (1996 and newer)	Light Duty Diesel (1997 and newer)
Franklin	74,904	398
Jefferson	158,322	553
St Charles	270,453	854
St Louis City	143,503	517
St Louis County	792,960	2,352
Total	**1,440,142**	**4,674**
Total Count	**1,444,816**	

The Air Program also queried the I/M report generator to determine the total number of vehicles, which had their emissions tested at least once from January 1, 2010 through December 31, 2011. The query also included the total number of vehicles that received waivers during the same time period. Table A-9 was generated with data from this query.

Table A-9 Initially Tested Vehicles that Received a Waiver in the St. Louis I/M Program from January 1, 2010 through December 31, 2011

Model Year	Passenger Car			Truck			Total Initially Tested		
	Test Count	Waivers	% Waivers	Test Count	Waivers	% Waivers	Test Count	Waivers	% Waivers
1996	32015	295	0.92 %	10024	75	0.75 %	42039	370	0.88 %
1997	40698	156	0.38 %	12314	34	0.28 %	53012	190	0.36 %
1998	52841	236	0.45 %	15709	72	0.46 %	68550	308	0.45 %
1999	63520	139	0.22 %	17052	28	0.16 %	80572	167	0.21 %
2000	78614	318	0.40 %	19769	67	0.34 %	98383	385	0.39 %
2001	80007	270	0.34 %	18769	39	0.21 %	98776	309	0.31 %
2002	97599	314	0.32 %	21911	62	0.28 %	119510	376	0.31 %
2003	90007	134	0.15 %	20853	18	0.09 %	110860	152	0.14 %
2004	99537	161	0.16 %	22613	34	0.15 %	122150	195	0.16 %
2005	103390	66	0.06 %	19223	11	0.06 %	122613	77	0.06 %
2006	101753	116	0.11 %	18218	18	0.10 %	119971	134	0.11 %
2007	113181	30	0.03 %	19128	4	0.02 %	132309	34	0.03 %
2008	109592	64	0.06 %	16640	14	0.08 %	126232	78	0.06 %
2009	82184	29	0.04 %	8984	0	0.00 %	91168	29	0.03 %
2010	27720	19	0.07 %	2918	3	0.10 %	30638	22	0.07 %
2011	7060	0	0.00 %	467	0	0.00 %	7527	0	0.00 %
2012	124	0	0.00 %	2	0	0.00 %	126	0	0.00 %
Total	1179842	2347	0.20 %	244594	479	0.20 %	1424436	2826	0.20 %

Using the data from Tables A-8 and A-9, the compliance rate is calculated for the St. Louis I/M Program with the following equation:

Compliance Rate: (1,424,436 / 1,444,816) x 100% = 98.59%

Waiver Rate

The waiver rate is the percentage of vehicles that fail an initial I/M test and do not pass a retest, but do receive a certificate of compliance. The waiver rate was determined by dividing the number of vehicles that received waivers from January 1, 2010 through December 31, 2011 by the total number of vehicles that were tested at least once during the same time period. Therefore, the waiver rate was calculated for the St. Louis I/M Program with the following equation:

Waiver Rate: (2,826 / 1,444,816) X 100% = 0.20%

Regulatory Class Coverage Adjustment

The regulatory class coverage adjustment is an adjustment that accounts for the fraction of vehicles within a source type that are covered by the I/M program. Since the I/M program in St. Louis exempts vehicles with a gross vehicle weight rating above 8,500 lbs., the compliance factor needs to reflect the percentage of vehicles in the source types subject to I/M that are exempt because of their GVWR. Table A.3 in the Appendix of the MOVES Technical Guidance

Document was used to develop adjustments to the compliance factor to account for this discrepancy. The adjustments are percentages of vehicle miles traveled by the various regulatory weight classes within a source type. The corresponding adjustment factors used for the three source categories are as follow:

Passenger cars: 100%
Passenger Trucks: 94%
Light Commercial Trucks: 88%

<u>Calculating the Compliance Factor</u>
Based on the calculations listed above the compliance factor for each source category impacted by the I/M program in St. Louis is listed below.
Passenger cars: 98.59% x (100% - 0.20%) x 100% = **98.39%**
Passenger Trucks: 98.59% x (100% - 0.20%) x 94% = **92.49%**
Light Commercial Trucks: 98.59% x (100% - 0.20%) x 88% = **86.59%**

All other MOVES input tables used to develop the 2011 onroad mobile source emissions for the St. Louis nonattainment area were MOVES default tables.

Once MOVES input tables had been created, the MOVES model runs were set up selecting all available gasoline and diesel fuel vehicle type combinations, all months, days, hours, and all road types. A separate run was set-up for each pollutant and each county. All pollutant processes were selected in each run, except for the VOC emissions from MOVES emission processes 18 and 19 (refueling displacement emissions, and refueling evaporative emissions), which are classified as area source emissions, and are not included in the mobile source emissions inventory (stage II onroad refueling VOC emissions are included in Appendix A-3). The emissions were post aggregated to the month level using MOVES and the emissions from the high ozone season months (June – August) were totaled and divided by 92, the number of days in those months, to give average ozone season day emissions.

Table A-10 summarizes the 2011 ozone season day onroad emissions by county as calculated using MOVES for the Missouri counties located in the St. Louis ozone nonattainment area. Tables A-11 through A-15 provide data used to develop all of the non-default MOVES inputs that were used to create the 2011 onroad mobile source emissions inventory that is summarized in Table A-10.

Table A-10 2011 Onroad Mobile Source Emissions by County in the St. Louis Ozone Nonattainment Area (tons/ozone season day)

County Name	CO	NO_X	VOC
Franklin County	21.18	7.83	2.40
Jefferson County	34.91	12.45	4.24
St. Charles County	56.63	21.04	6.73
St. Louis County	176.34	66.34	20.17
St. Louis City	42.14	16.55	4.46
Totals	**331.20**	**124.20**	**38.00**

Table A-11 2011 Source Type Population

			Source Type Population by County				
YearID	**SourceTypeName**	**SourceTypeID**	**Franklin**	**Jefferson**	**St Charles**	**St Louis County**	**St Louis City**
2011	Motorcycle	11	3,368	7,328	8,815	14,976	2,508
2011	Passenger Car	21	37,915	83,796	145,332	481,522	98,950
2011	Passenger Truck	31	41,877	77,459	113,499	293,099	51,907
2011	Light Commercial Truck	32	15,212	26,534	36,424	93,509	17,566
2011	Refuse Truck	41	12	44	40	77	28
2011	Single Unit Short-haul Truck	42	36	132	121	230	83
2011	Single Unit Long-haul Truck	43	258	490	507	1,994	322
2011	Motor Home	51	21	17	16	46	16
2011	School Bus	52	685	746	828	2,951	984
2011	Transit Bus	53	51	55	61	223	73
2011	Intercity Bus	54	39	62	74	309	111
2011	Combination Short-haul Truck	61	349	284	273	696	241
2011	Combination Long-haul Truck	62	287	223	211	461	160

Table A-12 2011 Annual VMT by HPMS Vehicle Type

			HPMSBaseYearVMT by County				
HPMSVtypeID	**HPMSVtypeName**	**YearID**	**Franklin**	**Jefferson**	**St. Charles**	**St. Louis**	**St. Louis City**
10	Motorcycles	2011	9,402,900	14,491,100	24,790,800	80,646,400	20,723,500
20	Passenger Cars	2011	665,927,000	1,026,280,000	1,755,720,000	5,711,490,000	1,467,660,000
30	Other 2 axle-4 tire vehicles	2011	255,497,000	393,754,000	673620,000	2,191,340,000	563,101,000
40	Buses	2011	4,851,600	7,476,950	12,791,300	41,611,000	10,692,600
50	Single Unit Trucks	2011	43,124,400	66,460,400	113,698,000	369,868,000	95,043,800
60	Combination Trucks	2011	121,424,000	187,130,000	320,135,000	1,041,420,000	267,612,000

Table A-13 Age Distribution by Source Type

	Source Type ID												
AgeID	11	21	31	32	41	42	43	51	52	53	54	61	62
0	0.0437	0.0634	0.0754994	0.0730922	0.0353	0.0353	0.0131157	0.0699563	0.0722387	0.0712437	0.0767933	0.070089	0.0700695
1	0.0377	0.0543	0.055495	0.05233	0.0254	0.0254	0.00556123	0.0345334	0.0348023	0.0353845	0.0333208	0.0341839	0.0337198
2	0.0786	0.0517	0.0378512	0.0368159	0.0128	0.0128	0.0369075	0.0335694	0.0353931	0.0354001	0.0367028	0.0332622	0.0327233
3	0.0928	0.0676	0.0657843	0.0659449	0.0177	0.0177	0.0674814	0.0450761	0.046131	0.0463597	0.0462448	0.0447794	0.0443175
4	0.0883	0.067	0.0606961	0.0604728	0.0389	0.0389	0.102261	0.130919	0.125325	0.126948	0.11659	0.130993	0.131549
5	0.0922	0.0667	0.0729758	0.0731956	0.0358	0.0358	0.0583784	0.069198	0.0760405	0.0767451	0.0789749	0.0676988	0.0652376
6	0.0702	0.0625	0.0746245	0.0731668	0.0221	0.0221	0.101702	0.0745635	0.072262	0.0733365	0.0674894	0.0743837	0.0743462
7	0.0624	0.0663	0.06945	0.0698834	0.0483	0.0483	0.117222	0.0655977	0.0568399	0.0578963	0.0474337	0.0664944	0.0683516
8	0.0666	0.0585	0.0671688	0.0671701	0.0568	0.0568	0.0751798	0.0647841	0.0548821	0.0562506	0.043743	0.0657076	0.0676931
9	0.0647	0.0693	0.0725558	0.071398	0.0257	0.0257	0.03851	0.0359123	0.0390661	0.0404876	0.0372438	0.0346524	0.0327981
10	0.0447	0.0573	0.0570976	0.0580126	0.032	0.032	0.0454963	0.0464053	0.0473284	0.0470494	0.0488094	0.0463963	0.046309
11	0.0421	0.0619	0.0530737	0.0546137	0.0419	0.0419	0.0647217	0.0760194	0.0616443	0.0612408	0.0523838	0.078603	0.0830581
12	0.0294	0.0464	0.0425809	0.0442593	0.0274	0.0274	0.0364442	0.0462603	0.0403742	0.039892	0.0374992	0.0474828	0.0495153
13	0.0258	0.0432	0.0376641	0.0367205	0.0202	0.0202	0.0250172	0.0329887	0.0300616	0.0298984	0.0284107	0.0335568	0.0345171
14	0.0176	0.0317	0.0276796	0.0292686	0.0193	0.0193	0.0226796	0.0286598	0.0346049	0.034717	0.0385967	0.0276185	0.0258107
15	0.0195	0.0282	0.0245116	0.0254385	0.0347	0.0347	0.0287746	0.0203365	0.025282	0.0252651	0.0289182	0.0195287	0.0180985
16	0.0137	0.0234	0.0181966	0.0194762	0.0301	0.0301	0.02054	0.0211695	0.0239684	0.0233927	0.0276531	0.0210102	0.0205771
17	0.0137	0.0203	0.0182143	0.0188362	0.0464	0.0464	0.0161092	0.0154848	0.0138635	0.0137987	0.012868	0.0157885	0.0163062
18	0.0108	0.0128	0.0110033	0.0112755	0.0459	0.0459	0.0104185	0.0128252	0.0138876	0.0137768	0.014966	0.0127116	0.0124797
19	0.0085	0.0125	0.0106089	0.0107185	0.0288	0.0288	0.00957892	0.00960533	0.00866861	0.00870015	0.00789284	0.0097454	0.0099997
20	0.0057	0.0078	0.00699207	0.00710837	0.0518	0.0518	0.00899488	0.00894388	0.0111119	0.0112144	0.0123824	0.00853451	0.00783743
21	0.0069	0.0074	0.00701561	0.00722442	0.0639	0.0639	0.0147649	0.00980085	0.014371	0.0134822	0.0202525	0.00950936	0.00876332
22	0.0051	0.0048	0.00708294	0.00720967	0.0392	0.0392	0.0162974	0.0107765	0.013405	0.0125415	0.0177943	0.0107962	0.0106038
23	0.0055	0.0043	0.00968463	0.00942128	0.0603	0.0603	0.00219043	0.00872934	0.0105431	0.00994061	0.0135956	0.00874497	0.00861485
24	0.00593137	0.00385208	0.0117369	0.0112228	0.0927574	0.0927574	0.000937131	0.00736488	0.00869688	0.00808993	0.0114157	0.00746131	0.0074733
25	0.00639658	0.00345083	0.00284412	0.00302786	0.0465426	0.0465426	0.000774663	0.00416412	0.00658159	0.00599327	0.0100354	0.00407108	0.00375386
26	0.00689827	0.00309136	0.000595516	0.000777315	0	0	0.000717907	0.00269594	0.0053876	0.00479226	0.00906118	0.00256107	0.00216833
27	0.00743931	0.000305728	0.000342063	0.000471563	0	0	0.000476073	0.00162332	0.00320526	0.00274239	0.00569006	0.0016031	0.00144695
28	0.00802279	0	0.000252993	0.000328952	0	0	0.0000259143	0.000789098	0.000543994	0.000526158	0.000416207	0.000839395	0.000923189
29	0.00865202	0	0.000202389	0.00023225	0	0	0.000012914	0.000548271	0.000356843	0.000350507	0.00023539	0.000583497	0.000643822
30	0.0104597	0	0.000519132	0.000886124	0	0	0.0587084	0.0106991	0.0131328	0.0125435	0.0165867	0.0106091	0.0102937

Table A-14 Inspection and Maintenance Data for 2011 (MOVES Inputs for 2011 Onroad Mobile Source Emissions)

Pol Process ID	State ID	Year ID	Source Type ID	Fuel Type ID	IM Program ID	Inspect Freq.	Test Standards ID	Beg Model Year ID	End Model Year ID	Use IM Y/N	Compliance Factor
101	29	2011	21	1	1	1	11	1971	1995	N	93.12
101	29	2011	21	1	10	2	51	1996	2009	Y	98.39
101	29	2011	31	1	1	1	11	1971	1995	N	93.12
101	29	2011	31	1	10	2	51	1996	2009	Y	92.49
101	29	2011	32	1	1	1	11	1971	1995	N	93.12
101	29	2011	32	1	10	2	51	1996	2009	Y	86.59
102	29	2011	21	1	1	1	11	1971	1995	N	93.12
102	29	2011	21	1	10	2	51	1996	2009	Y	98.39
102	29	2011	31	1	1	1	11	1971	1995	N	93.12
102	29	2011	31	1	10	2	51	1996	2009	Y	92.49
102	29	2011	32	1	1	1	11	1971	1995	N	93.12
102	29	2011	32	1	10	2	51	1996	2009	Y	86.59
112	29	2011	21	1	7	1	41	1971	1995	N	93.12
112	29	2011	21	1	8	2	43	1996	2009	Y	98.39
112	29	2011	31	1	7	1	41	1971	1995	N	93.12
112	29	2011	31	1	8	2	43	1996	2009	Y	92.49
112	29	2011	32	1	7	1	41	1971	1995	N	93.12
112	29	2011	32	1	8	2	43	1996	2009	Y	86.59
113	29	2011	21	1	7	1	41	1971	1995	N	93.12
113	29	2011	21	1	8	2	43	1996	2009	Y	98.39
113	29	2011	31	1	7	1	41	1971	1995	N	93.12
113	29	2011	31	1	8	2	43	1996	2009	Y	92.49
113	29	2011	32	1	7	1	41	1971	1995	N	93.12
113	29	2011	32	1	8	2	43	1996	2009	Y	86.59
201	29	2011	21	1	1	1	11	1971	1995	N	93.12
201	29	2011	21	1	10	2	51	1996	2009	Y	98.39
201	29	2011	31	1	1	1	11	1971	1995	N	93.12
201	29	2011	31	1	10	2	51	1996	2009	Y	92.49
201	29	2011	32	1	1	1	11	1971	1995	N	93.12
201	29	2011	32	1	10	2	51	1996	2009	Y	86.59

Pol Process ID	State ID	Year ID	Source Type ID	Fuel Type ID	IM Program ID	Inspect Freq.	Test Standards ID	Beg Model Year ID	End Model Year ID	Use IM Y/N	Compliance Factor
202	29	2011	21	1	1	1	11	1971	1995	N	93.12
202	29	2011	21	1	10	2	51	1996	2009	Y	98.39
202	29	2011	31	1	1	1	11	1971	1995	N	93.12
202	29	2011	31	1	10	2	51	1996	2009	Y	92.49
202	29	2011	32	1	1	1	11	1971	1995	N	93.12
202	29	2011	32	1	10	2	51	1996	2009	Y	86.59
301	29	2011	21	1	10	2	51	1996	2009	Y	98.39
301	29	2011	31	1	10	2	51	1996	2009	Y	92.49
301	29	2011	32	1	10	2	51	1996	2009	Y	86.59
302	29	2011	21	1	10	2	51	1996	2009	Y	98.39
302	29	2011	31	1	10	2	51	1996	2009	Y	92.49
302	29	2011	32	1	10	2	51	1996	2009	Y	86.59

Table A-15 Road Type Distribution (Used for All Nonattainment Area Counties)

Source Type ID	Road Type ID	Road Type VMT Fraction
11	1	0
11	2	0.017287
11	3	0.074576
11	4	0.616846
11	5	0.291291
21	1	0
21	2	0.017287
21	3	0.074576
21	4	0.616846
21	5	0.291291
31	1	0
31	2	0.017287
31	3	0.074576
31	4	0.616846
31	5	0.291291
32	1	0
32	2	0.017287
32	3	0.074576
32	4	0.616846
32	5	0.291291
41	1	0
41	2	0.017287
41	3	0.074576
41	4	0.616846
41	5	0.291291
42	1	0
42	2	0.017287
42	3	0.074576
42	4	0.616846
42	5	0.291291
43	1	0
43	2	0.017287
43	3	0.074576
43	4	0.616846
43	5	0.291291

Source Type ID	Road Type ID	Road Type VMT Fraction
51	1	0
51	2	0.017287
51	3	0.074576
51	4	0.616846
51	5	0.291291
52	1	0
52	2	0.017287
52	3	0.074576
52	4	0.616846
52	5	0.291291
53	1	0
53	2	0.017287
53	3	0.074576
53	4	0.616846
53	5	0.291291
54	1	0
54	2	0.017287
54	3	0.074576
54	4	0.616846
54	5	0.291291
61	1	0
61	2	0.017287
61	3	0.074576
61	4	0.616846
61	5	0.291291
62	1	0
62	2	0.017287
62	3	0.074576
62	4	0.616846
62	5	0.291291

Appendix A-5 2011 Nonroad Source Emissions

The 2011 nonroad source emissions were calculated for the Missouri counties in the St. Louis nonattainment area using the NONROAD 2008a model. The NONROAD2008a model provides the emissions for all nonroad source categories except aircraft, commercial marine vessel, and railroad locomotive.

In running the NONROAD model, the user must specify a modeling scenario by the inventory year, geographic area (nation, state, county), period (annual, seasonal, monthly, daily), and the equipment categories. For all other required variables, the NONROAD model provides default input values. For the following modeling exercises, fuel parameters (Reid Vapor Pressure (RVP), oxygen weight, sulfur content, ethanol volume and market percentage) and temperatures for each county in the Missouri portion of the nonattainment area were obtained from the national county database.

For modeling ozone precursor pollutants, temperatures and fuel characteristics representative of each county during an ozone summer weekday, were entered into NONROAD2008a and modeled to calculate an ozone season weekday emissions for nonroad sources. Minimum, maximum, and average temperatures for a typical summer season were obtained from the national county data base. All input data for the NONROAD 2008a model that was used to develop the 2011 nonroad emissions is included in Table A-16.

Table A-16 NONROAD Model Temperature & Fuel Characteristic Input Values by County

County	Season	Oxygen Weight %	RVP (psi)	Gasoline Sulfur %	Ethanol Volume %	Ethanol Market Share %	Diesel Sulfur	Marine Diesel Sulfur %	CNG/LPG Sulfur %	Temperatures		
										Min.	Max.	Avg.
Franklin	Summer	3.5	7	0.0049	10	100	0.0355	0.0402	0.003	61.8	90	75.9
Jefferson	Summer	3.5	7	0.0049	10	100	0.0355	0.0402	0.003	61	88.6	74.8
St. Charles	Summer	3.5	7	0.0049	10	100	0.0355	0.0402	0.003	62.2	89.2	75.7
St. Louis	Summer	3.5	7	0.0049	10	100	0.0355	0.0402	0.003	64.1	89.5	76.8
St. Louis City	Summer	3.5	7	0.0049	10	100	0.0355	0.0402	0.003	65.1	89.8	77.5

The data generated by the NONROAD model for the 2011 nonroad source emissions for the Missouri counties in the St. Louis ozone nonattainment area are summarized in Table A-17 in units of tons/ozone season day.

As stated in Appendices A-2 and A-3, EPA lists emissions data in the NEI for aircraft takeoffs and landings in the point source inventory and they include emissions data for commercial marine and locomotives in the non-point inventory. However, in this plan, these sources are classified as nonroad source emissions. Therefore, 2011 annual emissions data from the 2011 NEI for aircraft, marine, and rail emissions were converted to ozone season day emissions using the temporal allocation profile table listed in Appendix A-7, and these emissions were added to the nonroad source category. The 2011 emissions for aircraft, marine, and rail sources are summarized by county in Table A-18. The total 2011 nonroad source emissions by county are listed in Table A-19.

Table A-17 2011 Emissions by County in the St. Louis Ozone Nonattainment Area Calculated with NONROAD 2008a (Excludes Aircraft, Marine and Rail Emissions) (Tons per Ozone Season Day)

County Name	CO	NO_X	VOC
Franklin County	17.96	2.57	3.15
Jefferson County	28.57	2.64	3.09
St. Charles County	62.13	6.91	6.15
St. Louis County	308.04	18.62	22.39
St. Louis City	47.51	2.37	3.19
Totals	**464.21**	**33.11**	**37.97**

Table A-18 2011 Aircraft, Marine and Rail Emissions by County in the St. Louis Ozone Nonattainment Area (Tons per Ozone Season Day)

County Name	CO	NO_X	VOC
Franklin County	0.59	3.15	0.16
Jefferson County	0.11	0.69	0.03
St. Charles County	0.68	1.43	0.08
St. Louis County	7.20	5.23	0.60
St. Louis City	0.63	3.94	0.19
Totals	**9.21**	**14.44**	**1.06**

Table A-19 Total 2011 Nonroad Source Emissions by County in the St. Louis Ozone Nonattainment Area (Tons per Ozone Season Day) (Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	18.55	5.72	3.31
Jefferson County	28.68	3.33	3.12
St. Charles County	62.81	8.34	6.23
St. Louis County	315.24	23.85	22.99
St. Louis City	48.14	6.31	3.38
Totals	**473.42**	**47.55**	**39.03**

Appendix A-6 2011 Event and Biogenic Source Emissions

The 2011 event (wildfire) and biogenic source emissions by county for the Missouri portion of the 2008 St. Louis ozone nonattainment area are summarized below in Table A-20. The annual event and biogenic source emissions were extracted from the EPA's 2011 NEI for the counties located in the nonattainment area. The emissions in Table A-20 are given in tons/ozone season day. In order to calculate the ozone season day emissions for wildfires, EMCH temporal allocation profiles that are SCC-specific were applied to the annual emissions from this source category for a Tuesday in July. See Appendix A-7 for the temporal allocation method and table.

In order to calculate ozone season day biogenic emissions the monthly emissions were extracted from the 2011 NEI for the months during the high ozone season (June – August), and then summed for each county and divided by 92 (the number of days in those months). The monthly biogenic emissions during the high ozone season from 2011 for the Missouri nonattainment counties are displayed in Table A-21.

Table A-20 2011 Event (Wildfire) and Biogenic Source Emissions by County in the St. Louis Ozone Nonattainment Area (Tons per Ozone Season Day) (Missouri Counties Only)

County Name	Source Category	CO	NO_X	VOC
Franklin County	Event (Wildfires)	0.40	0.00	0.09
Jefferson County		0.28	0.00	0.07
St. Charles County		0.01	0.00	0.00
St. Louis County		0.01	0.00	0.00
St. Louis City		0.00	0.00	0.00
Totals		**0.69**	**0.01**	**0.16**
Franklin County	Biogenic Sources	11.58	1.09	126.84
Jefferson County		9.29	0.51	104.17
St. Charles County		7.09	1.05	65.94
St. Louis County		5.55	0.68	60.84
St. Louis City		1.03	0.13	10.93
Totals		**34.55**	**3.47**	**368.71**

Table A-22 2011 Biogenic Source Emissions by County and High Ozone Season Months in the St. Louis Ozone Nonattainment Area (Missouri Counties Only)

County	Month	CO Emissions	NO_X Emissions	VOC Emissions
Franklin County	June (tons)	311.07	36.93	3,455.48
	July (tons)	412.48	34.69	4,677.48
	August (tons)	342.21	29.11	3,536.77
Franklin County Total (tons/high ozone season)		**1,065.76**	**100.73**	**11,669.73**
Franklin County Total (tons/ozone season day)		**11.58**	**1.09**	**126.84**
Jefferson County	June (tons)	251.96	16.36	2,878.62
	July (tons)	329.3	16.8	3,823.19
	August (tons)	273.01	14.1	2,881.57
Jefferson County Total (tons/high ozone season)		**854.27**	**47.26**	**9,583.38**
Jefferson County Total (tons/ozone season day)		**9.29**	**0.51**	**104.17**
St Charles County	June (tons)	186.57	35.16	1,735.06
	July (tons)	254.98	33.63	2,454.11
	August (tons)	211.05	28	1,876.91
St. Charles County Total (tons/high ozone season)		**652.60**	**96.79**	**6,066.08**
St. Charles County Total (tons/ozone season day)		**7.09**	**1.05**	**65.94**
St Louis County	June (tons)	147.01	20.65	1,630.96
	July (tons)	199.17	22.53	2,245.92
	August (tons)	164.73	19.39	1,720.11
St Louis County Total (tons/high ozone season)		**510.91**	**62.57**	**5,596.99**
St. Louis County Total (tons/ozone season day)		**5.55**	**0.68**	**60.84**
St Louis City	June (tons)	27.22	3.97	298.15
	July (tons)	36.67	4.27	395.49
	August (tons)	30.73	3.82	311.59
St Louis City High Total (tons/high ozone season)		**94.62**	**12.06**	**1,005.23**
St. Louis City Total (tons/ozone season day)		**1.03**	**0.13**	**10.93**
Nonattainment Area Total (tons/high ozone season)		**3,178.16**	**319.41**	**33,921.41**
Nonattainment Area Total (tons/ozone season day)		**34.55**	**3.47**	**368.71**

Appendix A-7 Temporal Profile Documentation and Table

The procedures summarized in this appendix are based on the April 29, 2002 memorandum from Gregory Stella, U.S. EPA, “Temporal Allocation of Annual Emissions using EMCH Temporal Profiles.” Table A-22 provides all the temporal allocation profiles and corresponding values for a typical Tuesday in July, which were used to convert annual emissions from the area source category as well as nonroad emissions from aircraft, commercial marine, and rail sources into ozone season day emissions. Emissions from these source categories are calculated on an annual basis. They are then allocated to an average Tuesday in July ozone season day emissions through the following calculation steps:

The first step is to allocate annual emissions to a particular month. A monthly profile is selected based on the nonpoint Source Classification Code (SCC). The annual emissions are multiplied by the monthly weight factor from the profile divided by the total weight factor as follows:

Monthly Emissions = Annual Emissions * (July Profile / Total Monthly Factor)

Next, emissions for an average monthly day are estimated from the monthly total. Because the monthly profiles are not weighted for the specific number of days in each month, an average day per year is used in the calculation as shown below:

Average Day Emissions = Monthly Emissions / (Days per Year / Months per Year)
Average Day Emissions = Monthly Emissions / (365/12)

The average day’s emissions value is then converted to a specific day of the week. A weekly profile is selected based on a SCC. Using the day-of-week weighting factor from the profile, emissions for this day are calculated with the following equation:

Average Tuesday Emissions = Average Day Emissions * [(Tuesday Profile/ Total Weekly Factor) / (Average Day/Number of Days per Week)]

Average Tuesday Emissions = Average Day Emissions * [(Tuesday Profile/ Total Weekly Factor) / (1/7)]

<u>Example:</u>

St. Louis City (29510) Area Source Fuel Combustion – Industrial Bituminous/Subbituminous Coal Combustion

Annual Emissions of CO: 218.7 tons per year

July Profile: Profile Number 262 includes July Profile 83 and Monthly factor 996

Monthly emissions: 218.7 tons/year * (83/996) = 18.2 tons/ month

Average July Day Emissions: 18.2 tons/month / (365/12) = 0.59 tons/average day

Tuesday Profile: Profile Number 8 includes Tuesday Profile 147 and Weekly factor 1000

Average July Tuesday emissions: 0.59 tons /avg day * (147/1000) / (1/7) = 0.59 * 1.029 = 0.61 tons/day

Table A-22 Temporal Allocation Profile Table for an Average Tuesday in July for Area Source Categories (Missouri St. Louis Ozone Nonattainment Area Counties)

State And County FIPS Code	Source Classification Code	Monthly Profile Number	Monthly Weighting Numerator (July)	Monthly Weighting Denominator	Weekly Profile Number	Weekly Weighting Numerator (Tuesday)	Weekly Weighting Denominator	Weight Factor Tuesday
29071	28500201	262	83	996	7	143	1000	1.001
29099	28500201	262	83	996	7	143	1000	1.001
29183	28500201	262	83	996	7	143	1000	1.001
29189	28500201	262	83	996	7	143	1000	1.001
29510	28500201	262	83	996	7	143	1000	1.001
29071	2102001000	262	83	996	8	147	1000	1.029
29099	2102001000	262	83	996	8	147	1000	1.029
29183	2102001000	262	83	996	8	147	1000	1.029
29189	2102001000	262	83	996	8	147	1000	1.029
29510	2102001000	262	83	996	8	147	1000	1.029
29071	2102002000	262	83	996	8	147	1000	1.029
29099	2102002000	262	83	996	8	147	1000	1.029
29183	2102002000	262	83	996	8	147	1000	1.029
29189	2102002000	262	83	996	8	147	1000	1.029
29510	2102002000	262	83	996	8	147	1000	1.029
29071	2102004000	262	83	996	8	147	1000	1.029
29099	2102004000	262	83	996	8	147	1000	1.029
29183	2102004000	262	83	996	8	147	1000	1.029
29189	2102004000	262	83	996	8	147	1000	1.029
29510	2102004000	262	83	996	8	147	1000	1.029
29071	2102004001	262	83	996	7	143	1000	1.001
29071	2102004002	262	83	996	7	143	1000	1.001
29099	2102004001	262	83	996	7	143	1000	1.001
29099	2102004002	262	83	996	7	143	1000	1.001
29183	2102004001	262	83	996	7	143	1000	1.001
29183	2102004002	262	83	996	7	143	1000	1.001
29189	2102004001	262	83	996	7	143	1000	1.001
29189	2102004002	262	83	996	7	143	1000	1.001
29510	2102004001	262	83	996	7	143	1000	1.001
29510	2102004002	262	83	996	7	143	1000	1.001
29071	2102005000	262	83	996	8	147	1000	1.029
29099	2102005000	262	83	996	8	147	1000	1.029
29183	2102005000	262	83	996	8	147	1000	1.029
29189	2102005000	262	83	996	8	147	1000	1.029
29510	2102005000	262	83	996	8	147	1000	1.029
29071	2102006000	262	83	996	8	147	1000	1.029
29099	2102006000	262	83	996	8	147	1000	1.029
29183	2102006000	262	83	996	8	147	1000	1.029
29189	2102006000	262	83	996	8	147	1000	1.029
29510	2102006000	262	83	996	8	147	1000	1.029
29071	2102007000	262	83	996	8	147	1000	1.029
29099	2102007000	262	83	996	8	147	1000	1.029
29183	2102007000	262	83	996	8	147	1000	1.029
29189	2102007000	262	83	996	8	147	1000	1.029
29510	2102007000	262	83	996	8	147	1000	1.029
29071	2102008000	262	83	996	8	147	1000	1.029
29099	2102008000	262	83	996	8	147	1000	1.029
29183	2102008000	262	83	996	8	147	1000	1.029
29189	2102008000	262	83	996	8	147	1000	1.029
29510	2102008000	262	83	996	8	147	1000	1.029
29071	2102011000	262	83	996	8	147	1000	1.029
29099	2102011000	262	83	996	8	147	1000	1.029
29183	2102011000	262	83	996	8	147	1000	1.029
29189	2102011000	262	83	996	8	147	1000	1.029
29510	2102011000	262	83	996	8	147	1000	1.029
29071	2103001000	469	50	999	8	147	1000	1.029
29099	2103001000	469	50	999	8	147	1000	1.029
29183	2103001000	469	50	999	8	147	1000	1.029
29189	2103001000	469	50	999	8	147	1000	1.029
29510	2103001000	469	50	999	8	147	1000	1.029
29071	2103002000	469	50	999	8	147	1000	1.029
29099	2103002000	469	50	999	8	147	1000	1.029
29183	2103002000	469	50	999	8	147	1000	1.029
29189	2103002000	469	50	999	8	147	1000	1.029
29510	2103002000	469	50	999	8	147	1000	1.029
29071	2103004000	469	50	999	8	147	1000	1.029
29099	2103004000	469	50	999	8	147	1000	1.029

State And County FIPS Code	Source Classification Code	Monthly Profile Number	Monthly Weighting Numerator (July)	Monthly Weighting Denominator	Weekly Profile Number	Weekly Weighting Numerator (Tuesday)	Weekly Weighting Denominator	Weight Factor Tuesday
29183	2103004000	469	50	999	8	147	1000	1.029
29189	2103004000	469	50	999	8	147	1000	1.029
29510	2103004000	469	50	999	8	147	1000	1.029
29071	2103004001	469	50	999	8	147	1000	1.029
29071	2103004002	469	50	999	8	147	1000	1.029
29099	2103004001	469	50	999	8	147	1000	1.029
29099	2103004002	469	50	999	8	147	1000	1.029
29183	2103004001	469	50	999	8	147	1000	1.029
29183	2103004002	469	50	999	8	147	1000	1.029
29189	2103004001	469	50	999	8	147	1000	1.029
29189	2103004002	469	50	999	8	147	1000	1.029
29510	2103004001	469	50	999	8	147	1000	1.029
29510	2103004002	469	50	999	8	147	1000	1.029
29071	2103005000	469	50	999	8	147	1000	1.029
29099	2103005000	469	50	999	8	147	1000	1.029
29183	2103005000	469	50	999	8	147	1000	1.029
29189	2103005000	469	50	999	8	147	1000	1.029
29510	2103005000	469	50	999	8	147	1000	1.029
29071	2103006000	469	50	999	8	147	1000	1.029
29099	2103006000	469	50	999	8	147	1000	1.029
29183	2103006000	469	50	999	8	147	1000	1.029
29189	2103006000	469	50	999	8	147	1000	1.029
29510	2103006000	469	50	999	8	147	1000	1.029
29071	2103007000	262	83	996	8	147	1000	1.029
29099	2103007000	262	83	996	8	147	1000	1.029
29183	2103007000	262	83	996	8	147	1000	1.029
29189	2103007000	262	83	996	8	147	1000	1.029
29510	2103007000	262	83	996	8	147	1000	1.029
29071	2103008000	469	50	999	8	147	1000	1.029
29099	2103008000	469	50	999	8	147	1000	1.029
29183	2103008000	469	50	999	8	147	1000	1.029
29189	2103008000	469	50	999	8	147	1000	1.029
29510	2103008000	469	50	999	8	147	1000	1.029
29071	2103011000	262	83	996	8	147	1000	1.029
29099	2103011000	262	83	996	8	147	1000	1.029
29183	2103011000	262	83	996	8	147	1000	1.029
29189	2103011000	262	83	996	8	147	1000	1.029
29510	2103011000	262	83	996	8	147	1000	1.029
29071	2104002000	485	5	1002	7	143	1000	1.001
29099	2104002000	485	5	1002	7	143	1000	1.001
29183	2104002000	485	5	1002	7	143	1000	1.001
29189	2104002000	485	5	1002	7	143	1000	1.001
29510	2104002000	485	5	1002	7	143	1000	1.001
29071	2104004000	485	5	1002	7	143	1000	1.001
29099	2104004000	485	5	1002	7	143	1000	1.001
29183	2104004000	485	5	1002	7	143	1000	1.001
29189	2104004000	485	5	1002	7	143	1000	1.001
29510	2104004000	485	5	1002	7	143	1000	1.001
29071	2104006000	485	5	1002	7	143	1000	1.001
29099	2104006000	485	5	1002	7	143	1000	1.001
29183	2104006000	485	5	1002	7	143	1000	1.001
29189	2104006000	485	5	1002	7	143	1000	1.001
29510	2104006000	485	5	1002	7	143	1000	1.001
29071	2104007000	262	83	996	7	143	1000	1.001
29099	2104007000	262	83	996	7	143	1000	1.001
29183	2104007000	262	83	996	7	143	1000	1.001
29189	2104007000	262	83	996	7	143	1000	1.001
29510	2104007000	262	83	996	7	143	1000	1.001
29071	2104008100	485	5	1002	7	143	1000	1.001
29099	2104008100	485	5	1002	7	143	1000	1.001
29183	2104008100	485	5	1002	7	143	1000	1.001
29189	2104008100	485	5	1002	7	143	1000	1.001
29510	2104008100	485	5	1002	7	143	1000	1.001
29071	2104008210	485	5	1002	7	143	1000	1.001
29099	2104008210	485	5	1002	7	143	1000	1.001
29183	2104008210	485	5	1002	7	143	1000	1.001
29189	2104008210	485	5	1002	7	143	1000	1.001
29510	2104008210	485	5	1002	7	143	1000	1.001
29071	2104008220	485	5	1002	7	143	1000	1.001
29099	2104008220	485	5	1002	7	143	1000	1.001

State And County FIPS Code	Source Classification Code	Monthly Profile Number	Monthly Weighting Numerator (July)	Monthly Weighting Denominator	Weekly Profile Number	Weekly Weighting Numerator (Tuesday)	Weekly Weighting Denominator	Weight Factor Tuesday
29183	2104008220	485	5	1002	7	143	1000	1.001
29189	2104008220	485	5	1002	7	143	1000	1.001
29510	2104008220	485	5	1002	7	143	1000	1.001
29071	2104008230	485	5	1002	7	143	1000	1.001
29099	2104008230	485	5	1002	7	143	1000	1.001
29183	2104008230	485	5	1002	7	143	1000	1.001
29189	2104008230	485	5	1002	7	143	1000	1.001
29510	2104008230	485	5	1002	7	143	1000	1.001
29071	2104008310	485	5	1002	7	143	1000	1.001
29099	2104008310	485	5	1002	7	143	1000	1.001
29183	2104008310	485	5	1002	7	143	1000	1.001
29189	2104008310	485	5	1002	7	143	1000	1.001
29510	2104008310	485	5	1002	7	143	1000	1.001
29071	2104008320	485	5	1002	7	143	1000	1.001
29099	2104008320	485	5	1002	7	143	1000	1.001
29183	2104008320	485	5	1002	7	143	1000	1.001
29189	2104008320	485	5	1002	7	143	1000	1.001
29510	2104008320	485	5	1002	7	143	1000	1.001
29071	2104008330	485	5	1002	7	143	1000	1.001
29099	2104008330	485	5	1002	7	143	1000	1.001
29183	2104008330	485	5	1002	7	143	1000	1.001
29189	2104008330	485	5	1002	7	143	1000	1.001
29510	2104008330	485	5	1002	7	143	1000	1.001
29071	2104008400	485	5	1002	7	143	1000	1.001
29099	2104008400	485	5	1002	7	143	1000	1.001
29183	2104008400	485	5	1002	7	143	1000	1.001
29189	2104008400	485	5	1002	7	143	1000	1.001
29510	2104008400	485	5	1002	7	143	1000	1.001
29071	2104008510	485	5	1002	7	143	1000	1.001
29099	2104008510	485	5	1002	7	143	1000	1.001
29183	2104008510	485	5	1002	7	143	1000	1.001
29189	2104008510	485	5	1002	7	143	1000	1.001
29510	2104008510	485	5	1002	7	143	1000	1.001
29071	2104008610	485	5	1002	7	143	1000	1.001
29099	2104008610	485	5	1002	7	143	1000	1.001
29183	2104008610	485	5	1002	7	143	1000	1.001
29189	2104008610	485	5	1002	7	143	1000	1.001
29510	2104008610	485	5	1002	7	143	1000	1.001
29071	2104008700	262	83	996	7	143	1000	1.001
29099	2104008700	262	83	996	7	143	1000	1.001
29183	2104008700	262	83	996	7	143	1000	1.001
29189	2104008700	262	83	996	7	143	1000	1.001
29510	2104008700	262	83	996	7	143	1000	1.001
29071	2104009000	485	5	1002	7	143	1000	1.001
29099	2104009000	485	5	1002	7	143	1000	1.001
29183	2104009000	485	5	1002	7	143	1000	1.001
29189	2104009000	485	5	1002	7	143	1000	1.001
29510	2104009000	485	5	1002	7	143	1000	1.001
29071	2104011000	262	83	996	7	143	1000	1.001
29099	2104011000	262	83	996	7	143	1000	1.001
29183	2104011000	262	83	996	7	143	1000	1.001
29189	2104011000	262	83	996	7	143	1000	1.001
29510	2104011000	262	83	996	7	143	1000	1.001
29071	2265008005	22	115	1002	7	143	1000	1.001
29099	2265008005	22	115	1002	7	143	1000	1.001
29183	2265008005	22	115	1002	7	143	1000	1.001
29189	2265008005	22	115	1002	7	143	1000	1.001
29510	2265008005	22	115	1002	7	143	1000	1.001
29071	2267008005	262	83	996	7	143	1000	1.001
29099	2267008005	262	83	996	7	143	1000	1.001
29183	2267008005	262	83	996	7	143	1000	1.001
29189	2267008005	262	83	996	7	143	1000	1.001
29510	2267008005	262	83	996	7	143	1000	1.001
29071	2268008005	262	83	996	7	143	1000	1.001
29099	2268008005	262	83	996	7	143	1000	1.001
29183	2268008005	262	83	996	7	143	1000	1.001
29189	2268008005	262	83	996	7	143	1000	1.001
29510	2268008005	262	83	996	7	143	1000	1.001
29071	2270008005	21	115	999	7	143	1000	1.001
29099	2270008005	21	115	999	7	143	1000	1.001

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29183	2270008005	21	115	999	7	143	1000	1.001
29189	2270008005	21	115	999	7	143	1000	1.001
29510	2270008005	21	115	999	7	143	1000	1.001
29099	2275001000	262	83	996	7	143	1000	1.001
29183	2275001000	262	83	996	7	143	1000	1.001
29189	2275001000	262	83	996	7	143	1000	1.001
29510	2275001000	262	83	996	7	143	1000	1.001
29071	2275020000	246	87	1002	7	143	1000	1.001
29099	2275020000	246	87	1002	7	143	1000	1.001
29183	2275020000	246	87	1002	7	143	1000	1.001
29189	2275020000	246	87	1002	7	143	1000	1.001
29510	2275020000	246	87	1002	7	143	1000	1.001
29071	2275050011	262	83	996	7	143	1000	1.001
29099	2275050011	262	83	996	7	143	1000	1.001
29183	2275050011	262	83	996	7	143	1000	1.001
29189	2275050011	262	83	996	7	143	1000	1.001
29510	2275050011	262	83	996	7	143	1000	1.001
29071	2275050012	262	83	996	7	143	1000	1.001
29099	2275050012	262	83	996	7	143	1000	1.001
29183	2275050012	262	83	996	7	143	1000	1.001
29189	2275050012	262	83	996	7	143	1000	1.001
29510	2275050012	262	83	996	7	143	1000	1.001
29071	2275060011	246	87	1002	7	143	1000	1.001
29099	2275060011	246	87	1002	7	143	1000	1.001
29183	2275060011	246	87	1002	7	143	1000	1.001
29189	2275060011	246	87	1002	7	143	1000	1.001
29510	2275060011	246	87	1002	7	143	1000	1.001
29071	2275060012	246	87	1002	7	143	1000	1.001
29099	2275060012	246	87	1002	7	143	1000	1.001
29183	2275060012	246	87	1002	7	143	1000	1.001
29189	2275060012	246	87	1002	7	143	1000	1.001
29510	2275060012	246	87	1002	7	143	1000	1.001
29071	2275070000	246	87	1002	7	143	1000	1.001
29099	2275070000	246	87	1002	7	143	1000	1.001
29183	2275070000	246	87	1002	7	143	1000	1.001
29189	2275070000	246	87	1002	7	143	1000	1.001
29510	2275070000	246	87	1002	7	143	1000	1.001
29071	2285002006	262	83	996	7	143	1000	1.001
29071	2285002007	262	83	996	7	143	1000	1.001
29099	2285002006	262	83	996	7	143	1000	1.001
29099	2285002007	262	83	996	7	143	1000	1.001
29183	2285002006	262	83	996	7	143	1000	1.001
29183	2285002007	262	83	996	7	143	1000	1.001
29189	2285002006	262	83	996	7	143	1000	1.001
29189	2285002007	262	83	996	7	143	1000	1.001
29510	2285002006	262	83	996	7	143	1000	1.001
29510	2285002007	262	83	996	7	143	1000	1.001
29071	2285002010	262	83	996	7	143	1000	1.001
29099	2285002010	262	83	996	7	143	1000	1.001
29183	2285002010	262	83	996	7	143	1000	1.001
29189	2285002010	262	83	996	7	143	1000	1.001
29510	2285002010	262	83	996	7	143	1000	1.001
29071	2302002100	262	83	996	7	143	1000	1.001
29099	2302002100	262	83	996	7	143	1000	1.001
29183	2302002100	262	83	996	7	143	1000	1.001
29189	2302002100	262	83	996	7	143	1000	1.001
29510	2302002100	262	83	996	7	143	1000	1.001
29071	2302002200	262	83	996	7	143	1000	1.001
29099	2302002200	262	83	996	7	143	1000	1.001
29183	2302002200	262	83	996	7	143	1000	1.001
29189	2302002200	262	83	996	7	143	1000	1.001
29510	2302002200	262	83	996	7	143	1000	1.001
29071	2302003000	262	83	996	7	143	1000	1.001
29099	2302003000	262	83	996	7	143	1000	1.001
29183	2302003000	262	83	996	7	143	1000	1.001
29189	2302003000	262	83	996	7	143	1000	1.001
29510	2302003000	262	83	996	7	143	1000	1.001
29071	2302003100	262	83	996	7	143	1000	1.001
29099	2302003100	262	83	996	7	143	1000	1.001
29183	2302003100	262	83	996	7	143	1000	1.001

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29189	2302003100	262	83	996	7	143	1000	1.001
29510	2302003100	262	83	996	7	143	1000	1.001
29071	2302003200	262	83	996	7	143	1000	1.001
29099	2302003200	262	83	996	7	143	1000	1.001
29183	2302003200	262	83	996	7	143	1000	1.001
29189	2302003200	262	83	996	7	143	1000	1.001
29510	2302003200	262	83	996	7	143	1000	1.001
29071	2306000000	262	83	996	7	143	1000	1.001
29099	2306000000	262	83	996	7	143	1000	1.001
29183	2306000000	262	83	996	7	143	1000	1.001
29189	2306000000	262	83	996	7	143	1000	1.001
29510	2306000000	262	83	996	7	143	1000	1.001
29071	2401001000	199	85	999	7	143	1000	1.001
29099	2401001000	199	85	999	7	143	1000	1.001
29183	2401001000	199	85	999	7	143	1000	1.001
29189	2401001000	199	85	999	7	143	1000	1.001
29510	2401001000	199	85	999	7	143	1000	1.001
29071	2401005000	262	83	996	7	143	1000	1.001
29099	2401005000	262	83	996	7	143	1000	1.001
29183	2401005000	262	83	996	7	143	1000	1.001
29189	2401005000	262	83	996	7	143	1000	1.001
29510	2401005000	262	83	996	7	143	1000	1.001
29071	2401008000	262	83	996	7	143	1000	1.001
29099	2401008000	262	83	996	7	143	1000	1.001
29183	2401008000	262	83	996	7	143	1000	1.001
29189	2401008000	262	83	996	7	143	1000	1.001
29510	2401008000	262	83	996	7	143	1000	1.001
29071	2401015000	173	86	1002	7	143	1000	1.001
29099	2401015000	173	86	1002	7	143	1000	1.001
29183	2401015000	173	86	1002	7	143	1000	1.001
29189	2401015000	173	86	1002	7	143	1000	1.001
29510	2401015000	173	86	1002	7	143	1000	1.001
29071	2401020000	287	84	999	7	143	1000	1.001
29099	2401020000	287	84	999	7	143	1000	1.001
29183	2401020000	287	84	999	7	143	1000	1.001
29189	2401020000	287	84	999	7	143	1000	1.001
29510	2401020000	287	84	999	7	143	1000	1.001
29071	2401025000	287	84	999	7	143	1000	1.001
29099	2401025000	287	84	999	7	143	1000	1.001
29183	2401025000	287	84	999	7	143	1000	1.001
29189	2401025000	287	84	999	7	143	1000	1.001
29510	2401025000	287	84	999	7	143	1000	1.001
29071	2401030000	257	84	999	7	143	1000	1.001
29099	2401030000	257	84	999	7	143	1000	1.001
29183	2401030000	257	84	999	7	143	1000	1.001
29189	2401030000	257	84	999	7	143	1000	1.001
29510	2401030000	257	84	999	7	143	1000	1.001
29071	2401040000	253	84	999	7	143	1000	1.001
29099	2401040000	253	84	999	7	143	1000	1.001
29183	2401040000	253	84	999	7	143	1000	1.001
29189	2401040000	253	84	999	7	143	1000	1.001
29510	2401040000	253	84	999	7	143	1000	1.001
29071	2401050000	253	84	999	7	143	1000	1.001
29183	2401050000	253	84	999	7	143	1000	1.001
29189	2401050000	253	84	999	7	143	1000	1.001
29510	2401050000	253	84	999	7	143	1000	1.001
29071	2401055000	253	84	999	7	143	1000	1.001
29099	2401055000	253	84	999	7	143	1000	1.001
29183	2401055000	253	84	999	7	143	1000	1.001
29189	2401055000	253	84	999	7	143	1000	1.001
29510	2401055000	253	84	999	7	143	1000	1.001
29071	2401060000	262	83	996	7	143	1000	1.001
29099	2401060000	262	83	996	7	143	1000	1.001
29183	2401060000	262	83	996	7	143	1000	1.001
29189	2401060000	262	83	996	7	143	1000	1.001
29510	2401060000	262	83	996	7	143	1000	1.001
29071	2401065000	253	84	999	7	143	1000	1.001
29099	2401065000	253	84	999	7	143	1000	1.001
29183	2401065000	253	84	999	7	143	1000	1.001
29189	2401065000	253	84	999	7	143	1000	1.001

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29510	2401065000	253	84	999	7	143	1000	1.001
29071	2401070000	140	87	999	7	143	1000	1.001
29099	2401070000	140	87	999	7	143	1000	1.001
29183	2401070000	140	87	999	7	143	1000	1.001
29189	2401070000	140	87	999	7	143	1000	1.001
29510	2401070000	140	87	999	7	143	1000	1.001
29071	2401075000	169	87	1002	7	143	1000	1.001
29099	2401075000	169	87	1002	7	143	1000	1.001
29183	2401075000	169	87	1002	7	143	1000	1.001
29189	2401075000	169	87	1002	7	143	1000	1.001
29510	2401075000	169	87	1002	7	143	1000	1.001
29071	2401080000	266	84	999	7	143	1000	1.001
29099	2401080000	266	84	999	7	143	1000	1.001
29183	2401080000	266	84	999	7	143	1000	1.001
29189	2401080000	266	84	999	7	143	1000	1.001
29510	2401080000	266	84	999	7	143	1000	1.001
29071	2401085000	169	87	1002	7	143	1000	1.001
29099	2401085000	169	87	1002	7	143	1000	1.001
29183	2401085000	169	87	1002	7	143	1000	1.001
29189	2401085000	169	87	1002	7	143	1000	1.001
29510	2401085000	169	87	1002	7	143	1000	1.001
29071	2401090000	260	85	1005	7	143	1000	1.001
29099	2401090000	260	85	1005	7	143	1000	1.001
29183	2401090000	260	85	1005	7	143	1000	1.001
29189	2401090000	260	85	1005	7	143	1000	1.001
29510	2401090000	260	85	1005	7	143	1000	1.001
29071	2401100000	260	85	1005	7	143	1000	1.001
29099	2401100000	260	85	1005	7	143	1000	1.001
29183	2401100000	260	85	1005	7	143	1000	1.001
29189	2401100000	260	85	1005	7	143	1000	1.001
29510	2401100000	260	85	1005	7	143	1000	1.001
29071	2401200000	260	85	1005	7	143	1000	1.001
29099	2401200000	260	85	1005	7	143	1000	1.001
29183	2401200000	260	85	1005	7	143	1000	1.001
29189	2401200000	260	85	1005	7	143	1000	1.001
29510	2401200000	260	85	1005	7	143	1000	1.001
29071	2415000000	253	84	999	7	143	1000	1.001
29099	2415000000	253	84	999	7	143	1000	1.001
29183	2415000000	253	84	999	7	143	1000	1.001
29189	2415000000	253	84	999	7	143	1000	1.001
29510	2415000000	253	84	999	7	143	1000	1.001
29071	2420000000	199	85	999	7	143	1000	1.001
29099	2420000000	199	85	999	7	143	1000	1.001
29183	2420000000	199	85	999	7	143	1000	1.001
29189	2420000000	199	85	999	7	143	1000	1.001
29510	2420000000	199	85	999	7	143	1000	1.001
29071	2425000000	257	84	999	7	143	1000	1.001
29099	2425000000	257	84	999	7	143	1000	1.001
29183	2425000000	257	84	999	7	143	1000	1.001
29189	2425000000	257	84	999	7	143	1000	1.001
29510	2425000000	257	84	999	7	143	1000	1.001
29071	2460100000	262	83	996	7	143	1000	1.001
29099	2460100000	262	83	996	7	143	1000	1.001
29183	2460100000	262	83	996	7	143	1000	1.001
29189	2460100000	262	83	996	7	143	1000	1.001
29510	2460100000	262	83	996	7	143	1000	1.001
29071	2460200000	262	83	996	7	143	1000	1.001
29099	2460200000	262	83	996	7	143	1000	1.001
29183	2460200000	262	83	996	7	143	1000	1.001
29189	2460200000	262	83	996	7	143	1000	1.001
29510	2460200000	262	83	996	7	143	1000	1.001
29071	2460400000	262	83	996	7	143	1000	1.001
29099	2460400000	262	83	996	7	143	1000	1.001
29183	2460400000	262	83	996	7	143	1000	1.001
29189	2460400000	262	83	996	7	143	1000	1.001
29510	2460400000	262	83	996	7	143	1000	1.001
29071	2460500000	262	83	996	7	143	1000	1.001
29099	2460500000	262	83	996	7	143	1000	1.001
29183	2460500000	262	83	996	7	143	1000	1.001
29189	2460500000	262	83	996	7	143	1000	1.001

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29510	2460500000	262	83	996	7	143	1000	1.001
29071	2460600000	262	83	996	7	143	1000	1.001
29099	2460600000	262	83	996	7	143	1000	1.001
29183	2460600000	262	83	996	7	143	1000	1.001
29189	2460600000	262	83	996	7	143	1000	1.001
29510	2460600000	262	83	996	7	143	1000	1.001
29071	2460800000	262	83	996	7	143	1000	1.001
29099	2460800000	262	83	996	7	143	1000	1.001
29183	2460800000	262	83	996	7	143	1000	1.001
29189	2460800000	262	83	996	7	143	1000	1.001
29510	2460800000	262	83	996	7	143	1000	1.001
29071	2460900000	262	83	996	7	143	1000	1.001
29099	2460900000	262	83	996	7	143	1000	1.001
29183	2460900000	262	83	996	7	143	1000	1.001
29189	2460900000	262	83	996	7	143	1000	1.001
29510	2460900000	262	83	996	7	143	1000	1.001
29071	2461021000	258	84	1002	7	143	1000	1.001
29099	2461021000	258	84	1002	7	143	1000	1.001
29183	2461021000	258	84	1002	7	143	1000	1.001
29189	2461021000	258	84	1002	7	143	1000	1.001
29510	2461021000	258	84	1002	7	143	1000	1.001
29071	2461022000	258	84	1002	7	143	1000	1.001
29099	2461022000	258	84	1002	7	143	1000	1.001
29183	2461022000	258	84	1002	7	143	1000	1.001
29189	2461022000	258	84	1002	7	143	1000	1.001
29510	2461022000	258	84	1002	7	143	1000	1.001
29071	2461850001	258	84	1002	7	143	1000	1.001
29071	2461850002	258	84	1002	7	143	1000	1.001
29099	2461850002	258	84	1002	7	143	1000	1.001
29071	2461850003	258	84	1002	7	143	1000	1.001
29099	2461850003	258	84	1002	7	143	1000	1.001
29183	2461850003	258	84	1002	7	143	1000	1.001
29071	2461850004	258	84	1002	7	143	1000	1.001
29099	2461850004	258	84	1002	7	143	1000	1.001
29183	2461850004	258	84	1002	7	143	1000	1.001
29189	2461850004	258	84	1002	7	143	1000	1.001
29071	2461850005	258	84	1002	7	143	1000	1.001
29099	2461850005	258	84	1002	7	143	1000	1.001
29183	2461850005	258	84	1002	7	143	1000	1.001
29189	2461850005	258	84	1002	7	143	1000	1.001
29510	2461850005	258	84	1002	7	143	1000	1.001
29071	2461850006	258	84	1002	7	143	1000	1.001
29099	2461850006	258	84	1002	7	143	1000	1.001
29183	2461850006	258	84	1002	7	143	1000	1.001
29189	2461850006	258	84	1002	7	143	1000	1.001
29510	2461850006	258	84	1002	7	143	1000	1.001
29099	2461850007	258	84	1002	7	143	1000	1.001
29183	2461850007	258	84	1002	7	143	1000	1.001
29189	2461850007	258	84	1002	7	143	1000	1.001
29510	2461850007	258	84	1002	7	143	1000	1.001
29183	2461850008	258	84	1002	7	143	1000	1.001
29189	2461850008	258	84	1002	7	143	1000	1.001
29510	2461850008	258	84	1002	7	143	1000	1.001
29071	2461850009	258	84	1002	7	143	1000	1.001
29189	2461850009	258	84	1002	7	143	1000	1.001
29510	2461850009	258	84	1002	7	143	1000	1.001
29099	2461850010	258	84	1002	7	143	1000	1.001
29510	2461850010	258	84	1002	7	143	1000	1.001
29183	2461850011	258	84	1002	7	143	1000	1.001
29189	2461850012	258	84	1002	7	143	1000	1.001
29510	2461850013	258	84	1002	7	143	1000	1.001
29071	2461850051	258	84	1002	7	143	1000	1.001
29071	2461850052	258	84	1002	7	143	1000	1.001
29099	2461850052	258	84	1002	7	143	1000	1.001
29071	2461850053	258	84	1002	7	143	1000	1.001
29099	2461850053	258	84	1002	7	143	1000	1.001
29183	2461850053	258	84	1002	7	143	1000	1.001
29071	2461850054	258	84	1002	7	143	1000	1.001
29099	2461850054	258	84	1002	7	143	1000	1.001
29183	2461850054	258	84	1002	7	143	1000	1.001

State And County FIPS Code	Source Classification Code	Monthly Profile Number	Monthly Weighting Numerator (July)	Monthly Weighting Denominator	Weekly Profile Number	Weekly Weighting Numerator (Tuesday)	Weekly Weighting Denominator	Weight Factor Tuesday
29189	2461850054	258	84	1002	7	143	1000	1.001
29071	2461850055	258	84	1002	7	143	1000	1.001
29099	2461850055	258	84	1002	7	143	1000	1.001
29183	2461850055	258	84	1002	7	143	1000	1.001
29189	2461850055	258	84	1002	7	143	1000	1.001
29510	2461850055	258	84	1002	7	143	1000	1.001
29071	2461850056	258	84	1002	7	143	1000	1.001
29099	2461850056	258	84	1002	7	143	1000	1.001
29183	2461850056	258	84	1002	7	143	1000	1.001
29189	2461850056	258	84	1002	7	143	1000	1.001
29510	2461850056	258	84	1002	7	143	1000	1.001
29099	2461850057	258	84	1002	7	143	1000	1.001
29183	2461850057	258	84	1002	7	143	1000	1.001
29189	2461850057	258	84	1002	7	143	1000	1.001
29510	2461850057	258	84	1002	7	143	1000	1.001
29183	2461850058	258	84	1002	7	143	1000	1.001
29189	2461850058	258	84	1002	7	143	1000	1.001
29510	2461850058	258	84	1002	7	143	1000	1.001
29189	2461850059	258	84	1002	7	143	1000	1.001
29510	2461850059	258	84	1002	7	143	1000	1.001
29510	2461850060	258	84	1002	7	143	1000	1.001
29071	2461850099	258	84	1002	7	143	1000	1.001
29099	2461850100	258	84	1002	7	143	1000	1.001
29183	2461850101	258	84	1002	7	143	1000	1.001
29189	2461850102	258	84	1002	7	143	1000	1.001
29510	2461850103	258	84	1002	7	143	1000	1.001
29071	2501011011	262	83	996	7	143	1000	1.001
29099	2501011011	262	83	996	7	143	1000	1.001
29183	2501011011	262	83	996	7	143	1000	1.001
29189	2501011011	262	83	996	7	143	1000	1.001
29510	2501011011	262	83	996	7	143	1000	1.001
29071	2501011012	262	83	996	7	143	1000	1.001
29099	2501011012	262	83	996	7	143	1000	1.001
29183	2501011012	262	83	996	7	143	1000	1.001
29189	2501011012	262	83	996	7	143	1000	1.001
29510	2501011012	262	83	996	7	143	1000	1.001
29071	2501011013	262	83	996	7	143	1000	1.001
29099	2501011013	262	83	996	7	143	1000	1.001
29183	2501011013	262	83	996	7	143	1000	1.001
29189	2501011013	262	83	996	7	143	1000	1.001
29510	2501011013	262	83	996	7	143	1000	1.001
29071	2501011014	262	83	996	7	143	1000	1.001
29099	2501011014	262	83	996	7	143	1000	1.001
29183	2501011014	262	83	996	7	143	1000	1.001
29189	2501011014	262	83	996	7	143	1000	1.001
29510	2501011014	262	83	996	7	143	1000	1.001
29071	2501011015	262	83	996	7	143	1000	1.001
29099	2501011015	262	83	996	7	143	1000	1.001
29183	2501011015	262	83	996	7	143	1000	1.001
29189	2501011015	262	83	996	7	143	1000	1.001
29510	2501011015	262	83	996	7	143	1000	1.001
29071	2501012011	262	83	996	7	143	1000	1.001
29099	2501012011	262	83	996	7	143	1000	1.001
29183	2501012011	262	83	996	7	143	1000	1.001
29189	2501012011	262	83	996	7	143	1000	1.001
29510	2501012011	262	83	996	7	143	1000	1.001
29071	2501012012	262	83	996	7	143	1000	1.001
29099	2501012012	262	83	996	7	143	1000	1.001
29183	2501012012	262	83	996	7	143	1000	1.001
29189	2501012012	262	83	996	7	143	1000	1.001
29510	2501012012	262	83	996	7	143	1000	1.001
29071	2501012013	262	83	996	7	143	1000	1.001
29099	2501012013	262	83	996	7	143	1000	1.001
29183	2501012013	262	83	996	7	143	1000	1.001
29189	2501012013	262	83	996	7	143	1000	1.001
29510	2501012013	262	83	996	7	143	1000	1.001
29071	2501012014	262	83	996	7	143	1000	1.001
29099	2501012014	262	83	996	7	143	1000	1.001
29183	2501012014	262	83	996	7	143	1000	1.001
29189	2501012014	262	83	996	7	143	1000	1.001

State And County FIPS Code	Source Classification Code	Monthly Profile Number	Monthly Weighting Numerator (July)	Monthly Weighting Denominator	Weekly Profile Number	Weekly Weighting Numerator (Tuesday)	Weekly Weighting Denominator	Weight Factor Tuesday
29510	2501012014	262	83	996	7	143	1000	1.001
29071	2501012015	262	83	996	7	143	1000	1.001
29099	2501012015	262	83	996	7	143	1000	1.001
29183	2501012015	262	83	996	7	143	1000	1.001
29189	2501012015	262	83	996	7	143	1000	1.001
29510	2501012015	262	83	996	7	143	1000	1.001
29071	2501050120	262	83	996	7	143	1000	1.001
29099	2501050120	262	83	996	7	143	1000	1.001
29183	2501050120	262	83	996	7	143	1000	1.001
29189	2501050120	262	83	996	7	143	1000	1.001
29510	2501050120	262	83	996	7	143	1000	1.001
29071	2501055120	262	83	996	7	143	1000	1.001
29099	2501055120	262	83	996	7	143	1000	1.001
29183	2501055120	262	83	996	7	143	1000	1.001
29189	2501055120	262	83	996	7	143	1000	1.001
29510	2501055120	262	83	996	7	143	1000	1.001
29099	2501060052	262	83	996	7	143	1000	1.001
29183	2501060052	262	83	996	7	143	1000	1.001
29189	2501060052	262	83	996	7	143	1000	1.001
29510	2501060052	262	83	996	7	143	1000	1.001
29071	2501060053	262	83	996	7	143	1000	1.001
29071	2501060101	262	83	996	7	143	1000	1.001
29071	2501060102	262	83	996	7	143	1000	1.001
29099	2501060102	262	83	996	7	143	1000	1.001
29071	2501060103	262	83	996	7	143	1000	1.001
29099	2501060103	262	83	996	7	143	1000	1.001
29183	2501060103	262	83	996	7	143	1000	1.001
29099	2501060104	262	83	996	7	143	1000	1.001
29183	2501060104	262	83	996	7	143	1000	1.001
29189	2501060104	262	83	996	7	143	1000	1.001
29183	2501060105	262	83	996	7	143	1000	1.001
29189	2501060105	262	83	996	7	143	1000	1.001
29510	2501060105	262	83	996	7	143	1000	1.001
29189	2501060106	262	83	996	7	143	1000	1.001
29510	2501060106	262	83	996	7	143	1000	1.001
29510	2501060107	262	83	996	7	143	1000	1.001
29071	2501060201	262	83	996	7	143	1000	1.001
29099	2501060201	262	83	996	7	143	1000	1.001
29183	2501060201	262	83	996	7	143	1000	1.001
29189	2501060201	262	83	996	7	143	1000	1.001
29510	2501060201	262	83	996	7	143	1000	1.001
29071	2501070100	262	83	996	7	143	1000	1.001
29099	2501070101	262	83	996	7	143	1000	1.001
29183	2501070102	262	83	996	7	143	1000	1.001
29189	2501070103	262	83	996	7	143	1000	1.001
29510	2501070104	262	83	996	7	143	1000	1.001
29071	2501080050	262	83	996	7	143	1000	1.001
29099	2501080050	262	83	996	7	143	1000	1.001
29183	2501080050	262	83	996	7	143	1000	1.001
29189	2501080050	262	83	996	7	143	1000	1.001
29510	2501080050	262	83	996	7	143	1000	1.001
29071	2501080100	262	83	996	7	143	1000	1.001
29099	2501080100	262	83	996	7	143	1000	1.001
29183	2501080100	262	83	996	7	143	1000	1.001
29189	2501080100	262	83	996	7	143	1000	1.001
29510	2501080100	262	83	996	7	143	1000	1.001
29071	2505030120	262	83	996	7	143	1000	1.001
29099	2505030120	262	83	996	7	143	1000	1.001
29183	2505030120	262	83	996	7	143	1000	1.001
29189	2505030120	262	83	996	7	143	1000	1.001
29510	2505030120	262	83	996	7	143	1000	1.001
29071	2505040120	262	83	996	7	143	1000	1.001
29099	2505040120	262	83	996	7	143	1000	1.001
29183	2505040120	262	83	996	7	143	1000	1.001
29189	2505040120	262	83	996	7	143	1000	1.001
29510	2505040120	262	83	996	7	143	1000	1.001
29071	2610000100	262	83	996	7	143	1000	1.001
29099	2610000100	262	83	996	7	143	1000	1.001
29183	2610000100	262	83	996	7	143	1000	1.001
29189	2610000100	262	83	996	7	143	1000	1.001

State And County FIPS Code	Source Classification Code	Monthly Profile Number	Monthly Weighting Numerator (July)	Monthly Weighting Denominator	Weekly Profile Number	Weekly Weighting Numerator (Tuesday)	Weekly Weighting Denominator	Weight Factor Tuesday
29510	2610000100	262	83	996	7	143	1000	1.001
29071	2610000400	262	83	996	7	143	1000	1.001
29099	2610000400	262	83	996	7	143	1000	1.001
29183	2610000400	262	83	996	7	143	1000	1.001
29189	2610000400	262	83	996	7	143	1000	1.001
29510	2610000400	262	83	996	7	143	1000	1.001
29071	2610000500	262	83	996	7	143	1000	1.001
29099	2610000500	262	83	996	7	143	1000	1.001
29183	2610000500	262	83	996	7	143	1000	1.001
29189	2610000500	262	83	996	7	143	1000	1.001
29510	2610000500	262	83	996	7	143	1000	1.001
29071	2610030000	262	83	996	7	143	1000	1.001
29099	2610030000	262	83	996	7	143	1000	1.001
29183	2610030000	262	83	996	7	143	1000	1.001
29189	2610030000	262	83	996	7	143	1000	1.001
29510	2610030000	262	83	996	7	143	1000	1.001
29071	2630020000	262	83	996	7	143	1000	1.001
29099	2630020000	262	83	996	7	143	1000	1.001
29183	2630020000	262	83	996	7	143	1000	1.001
29189	2630020000	262	83	996	7	143	1000	1.001
29510	2630020000	262	83	996	7	143	1000	1.001
29071	2701200000	262	83	996	7	143	1000	1.001
29099	2701200000	262	83	996	7	143	1000	1.001
29183	2701200000	262	83	996	7	143	1000	1.001
29189	2701200000	262	83	996	7	143	1000	1.001
29510	2701200000	262	83	996	7	143	1000	1.001
29071	2701220000	262	83	996	7	143	1000	1.001
29099	2701220000	262	83	996	7	143	1000	1.001
29183	2701220000	262	83	996	7	143	1000	1.001
29189	2701220000	262	83	996	7	143	1000	1.001
29510	2701220000	262	83	996	7	143	1000	1.001
29071	2801500000	2046	0	992	35	140	998	0.982
29099	2801500000	2046	0	992	35	140	998	0.982
29183	2801500000	2046	0	992	35	140	998	0.982
29189	2801500000	2046	0	992	35	140	998	0.982
29510	2801500000	2046	0	992	35	140	998	0.982
29071	2810001000	1129	16	1000	7	143	1000	1.001
29099	2810001000	1129	16	1000	7	143	1000	1.001
29183	2810001000	1129	16	1000	7	143	1000	1.001
29189	2810001000	1129	16	1000	7	143	1000	1.001
29510	2810001000	1129	16	1000	7	143	1000	1.001
29071	2810060100	262	83	996	7	143	1000	1.001
29099	2810060100	262	83	996	7	143	1000	1.001
29183	2810060100	262	83	996	7	143	1000	1.001
29189	2810060100	262	83	996	7	143	1000	1.001
29510	2810060100	262	83	996	7	143	1000	1.001
29071	2810060200	262	83	996	7	143	1000	1.001
29099	2810060200	262	83	996	7	143	1000	1.001
29183	2810060200	262	83	996	7	143	1000	1.001
29189	2810060200	262	83	996	7	143	1000	1.001
29510	2810060200	262	83	996	7	143	1000	1.001
29071	2811015000	1029	0	1000	7	143	1000	1.001
29099	2811015000	1029	0	1000	7	143	1000	1.001
29183	2811015000	1029	0	1000	7	143	1000	1.001
29189	2811015000	1029	0	1000	7	143	1000	1.001
29510	2811015000	1029	0	1000	7	143	1000	1.001

Appendix B

Documentation of Missouri's
2011 National Emissions Inventory Data

Missouri Department of Natural Resources
Division of Environmental Quality
Air Pollution Control Program
Jefferson City, Missouri

Public Hearing
May 29, 2014

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1.0 Introduction

The Missouri Department of Natural Resources' Air Pollution Control Program developed a comprehensive statewide emissions inventory for 2011, as required by the EPA's Air Emissions Reporting Requirements (AERR) rule published December 17, 2008. The inventory includes point, nonpoint, onroad mobile, and nonroad mobile source emissions. This document describes how the 2011 inventory is compiled and submitted to the National Emissions Inventory (NEI) through the EPA's Emission Inventory System (EIS). This report documents the 2011 inventory in detail, from its creation, quality assurance, and final summaries. It also details the qualifications and limitations of the inventory.

Various tables are included showing summarized, facility-specific, and source category-specific data. All emission amounts are given in tons per year unless otherwise noted. Blank fields and those with dashes indicate a value of zero. Fields with 0, 0.0, or 0.00 contain small values that round to zero.

2.0 Pollutants

The 2011 inventory includes emissions of the traditional criteria air pollutants (CAPs) sulfur oxides (SO_x), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC), coarse particulate matter (PM_{10} Primary), fine particulate matter ($PM_{2.5}$ Primary), ammonia (NH_3), and lead (Pb). Missouri also inventories speciated Hazardous Air Pollutant (HAP) emissions for certain data categories. For some data categories, particulate matter (PM) is further disaggregated to its component parts: PM_{10} Primary is the sum of PM condensable (PM CON) and PM_{10} Filterable (PM_{10} FIL), and $PM_{2.5}$ Primary is the sum of PM condensable (PM CON) and $PM_{2.5}$ Filterable ($PM_{2.5}$ FIL). Missouri's inventory does not include greenhouse gas (GHG) emissions and none of the tables in this document will summarize GHGs. Only the nonpoint fuel combustion category contains GHG emission estimates where those pollutants were already part of the tool provided by a third-party contractor.

Table 1: Statewide 2011 Emissions

	Lead	NH_3	CO	NO_X	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	VOC
Point Total	42.20	1,642	113,272	92,721	16,727	9,834	255,217	14,503
Nonpoint Total	1.63	115,151	124,464	14,403	831,546	124,664	995	105,932
Onroad Total		2,588	599,054	180,579	1,208	61,785	8,416	6,760
Nonroad Total	3.27	5,382	362,916	79,213	9,734	7,971	1,631	48,250
Biogenic Total			138,954	28,311				1,168,254
Missouri Total	47.10	124,764	1,338,659	395,228	859,215	204,254	266,258	1,343,699

3.0 Geographic Coverage

The 2011 emissions inventory covers the entire state of Missouri. Point source emissions are prepared at the facility level with a geographic coordinate. Nonpoint, onroad, nonroad mobile, and biogenic emissions are submitted at the county level. There are no tribal areas in Missouri, and all 115 counties and municipalities are included.

4.0 Temporal Coverage

Annual emissions are developed for point, nonpoint, onroad mobile and nonroad mobile sources. The emissions cover a continuous 12 month period from January 1 to December 31 of the reporting year. Ozone season day emissions are submitted only for point sources in the 5-county St. Louis Ozone Nonattainment area (Franklin, Jefferson, St. Charles, and St. Louis Counties and the City of St. Louis). These emission estimates detail the amount of emissions on a typical summer day during the peak ozone season from June 1 through August 31. Only the ozone precursor pollutants of NO_x, VOC and CO are reported at this temporal scale.

5.0 Staff Resources

The department's Air Pollution Control Program (APCP) Air Quality Analysis (AQA) Section, Data Management Unit, prepared the 2011 emissions inventory with assistance from other APCP units. Local agencies in the Kansas City, St. Louis County, St. Louis City, and Springfield areas did not participate in inventory collection or quality assurance, but they do assist with identification of point source facilities. The individuals making up the 2011 NEI preparation team and their responsibilities are listed below:

- Stacy Allen, Data Management Unit Chief: Oversight of point, and nonpoint source development, quality assurance, and data submission
- Jeanne Brown, Data Management Unit: Point source data entry, quality assurance, and data submission
- Josh Martin, Data Management Unit: Point source quality assurance; HAP quality assurance
- Nathan O'Neil, Data Management Unit: Point source quality assurance; nonpoint source development and data submission; mobile source development and data submission
- Mary Powell, Data Management Unit: Point source data entry and quality assurance
- Terry Stock, Data Management Unit: Point source quality assurance and nonpoint source development
- Brenda Wansing, Data Management Unit: Point source data entry, quality assurance, and data submission
- Dan Williams, Data Management Unit: Point source quality assurance and nonpoint source development
- Aaron Basham, Rules Unit: Nonpoint source quality assurance
- Mark Leath, SIP Unit: Nonpoint source quality assurance
- Paul Myers, Rules Unit: Nonpoint source quality assurance
- Stan Payne, Rules Unit: Nonpoint source quality assurance
- Shelly Reimer, Rules Unit: Nonpoint source quality assurance
- Seanmichael Stanley, Rules Unit Planning Section: Nonpoint source quality assurance

6.0 Data Collection and Handling

6.1. Point Sources

Point source data is collected from permitted facilities in the form of a report called the Emissions Inventory Questionnaire (EIQ). The EIQ is a report detailing facility operational data and estimating the amount of air pollution emitted, and its collection is governed by Missouri Statute 10 CSR 10-6.110. The facility will either submit a detailed annual "full" report, with updated calendar year operations and emissions, or a "reduced" report, which represents that their last full report emissions are a reasonable estimate for the current year, within emission change and permit tolerances. These reports are certified by the facility, but are subject to review and revision based on quality assurance performed by the state, or notification by the facility of errors in the original submission. The point data presented in this report reflects all updates made to emission reports through February 1, 2014.

The AERR definition of Type A and B point source facilities depends on the pollutant-specific PTE and location within a designated nonattainment area. Since Missouri does not maintain records of facility total potential to emit, the permit type is used to determine Type A and Type B status. Missouri has one area designated as both a moderate ozone nonattainment area and moderate PM nonattainment area, so the Type B thresholds for SO_x, VOC, NO_x, CO, Pb, PM_{10} and NH_3 are compared to permit thresholds. Per Missouri operating permit rule 10 CSR 10-6.065, Part 70 sources and Intermediate sources have uncontrolled PTE of at least one pollutant in excess of the AERR Type B thresholds. All Missouri sources with Part 70 or Intermediate operating permits are submitted as Type B sources, and they are required to complete the "full" emissions report, detailing their actual operations and emissions during the 2011 year. Emission units permitted at the facility via their construction or operating permit are included in the report, including both stack and fugitive emission releases.

A fully detailed emission report contains several elements, most of which originated and continue to exist on paper EIQ forms. The following list provides brief description of the forms available for use in completing an EIQ, and the forms themselves appear in Appendix B-1. In general, forms beginning with number one (1) provide general facility information, and forms beginning with a two (2) provide detailed annual emission calculations. More information on EIQ forms is available at http://www.dnr.mo.gov/env/apcp/moeis/emissionsreporting.htm

Form Name	Form Description	Form Number
Form 1.0 General Plant Information	General plant information, plant-wide emissions totals, signature section certifying submitted information is accurate and complete.	780-1431

Form Name	Form Description	Form Number
Form 1.1 Process Flow Diagram	Diagram identifying and linking all emission units, processes, air pollution control devices, and emission release points for a facility.	780-1619
Form 1.2 Summary of Emission Units and Related Processes	List of all emission units, associated processes, and unit operating status.	780-1620
Form 2.0 Emission Unit Information	Main emissions reporting form; separate Form 2.0 required for each significant process for which emissions are being reported.	780-1621
Form 2.0C Control Device Information	Control device information when there is a control device operative at an emission unit; separate Form 2.0C required for each control device.	780-1434
Form 2.0K Charcoal Kiln Information	Details the operations and characteristics of charcoal kilns.	780-1530
Form 2.0L Landfill Information	Form for reporting emissions from landfills.	780-1583
Form 2.0P Portable Equipment Information	Details the locations and operations for portable equipment operations including quarries, asphalt plants, and concrete batch plants.	780-1433
Form 2.0S Stack/Vent Information	Stack information for emission units where emissions from a process enter the ambient air through one or more stacks/vents.	780-1435
Form 2.0Z Ozone Season Information Form	Calculation of ozone season day emissions of VOC, NO_x, or CO; required from facilities located in the St. Louis ozone nonattainment counties of St. Louis, St. Charles, Franklin and Jefferson Counties and St. Louis City.	780-1452
Form 2.1 Fuel Combustion Worksheet	Combustion equipment itemization including equipment design rate and fuel type.	780-1436
Form 2.2 Incinerator Worksheet	Information related to the incinerator, waste material(s) incinerated, and the annual waste material throughput.	780-1438
Form 2.3 VOC Process Mass-Balance Worksheet	Calculates a VOC mass balance emission factor from one or more VOC-containing materials.	780-1440

Form Name	Form Description	Form Number
Form 2.4 Volatile Organic Liquid Loading Worksheet	Calculates an emission factor for petroleum liquid loading into tank trucks, rail cars, and barges based on AP-42.	780-1625
Form 2.5L General Liquid Storage Tank Information	Information about storage tanks.	780-1444
Form 2.7 Haul Road Fugitive Emissions Worksheet	Calculates an emission factor for unpaved haul roads based on AP-42 formula.	780-1445
Form 2.8 Storage Pile Worksheet	Calculates emission factors for activity and wind erosion from storage piles based on AP-42 formulas.	780-1446
Form 2.9 Stack Test/Continuous Emission Monitoring Worksheet	Documentation for emission factors derived from stack tests or CEM devices.	780-1447
Form 2.T Hazardous Air Pollutant Worksheet	Speciates HAP chemicals emitted at the process level; separates individual HAPs from those included in VOC/PM emissions.	780-1448
Form 3.0 Emission Fee Calculation	Summary table showing emissions from all processes.	780-1509
Form 3.0CK Emission Fee Calculation for Charcoal Kilns	Summary table showing emissions from charcoal kiln operations.	780-1508
Dry Cleaner – Non-chlorinated and Petroleum Based Solvents	Emissions calculations for dry cleaners using non-chlorinated solvent and with combined dryer capacity of 84 pounds or more.	780-1954
Form 4.0 Financial Cost Estimate	Estimate the cost of complying with air pollution regulation.	780-1622

Though paper forms were the origination of emission reporting, Missouri now has an online emission reporting system called the Missouri Emission Inventory System, or MoEIS. The data elements on the hardcopy forms have an electronic counterpart in MoEIS, though several data elements which were calculated by the user and written on the form are now automatically populated by MoEIS. For the full emission reports submitted by an AERR Type A or B facility, the report can be submitted either on paper forms or via MoEIS. Both submittals require a signature page to certify that representative emissions have been reported, to the best knowledge of the facility representative.

All data elements for full emission reports are stored in the underlying MoEIS database. For reports that are submitted on paper forms, the data is entered to the MoEIS database by the APCP staff members

within a few weeks of receipt. Both the number and type of reports submitted annually are monitored to ensure proper coverage of AERR-reportable point source facilities. Paper forms were due by April 1, 2012, and MoEIS submissions were due by May 1, 2012. Late reports from AERR point source facilities were collected through reminders, enforcement actions, or site visits.

EIQ solicitations for calendar year 2011 were mailed to facilities in January 2012. A total of 2,237 EIQs were mailed statewide, of which 676 were full EIQs and 1,561 were reduced reporting forms. Of those 676 full reports, 505 facility reports are for AERR Type A or B facilities, and are included as point sources in Missouri's submittal to the NEI.

6.2 Nonpoint Sources

Nonpoint emission estimates come from a variety of input data sources, including but not limited to:

- US Census population, employment, and industrial datasets
- US Census of Agriculture activity data
- Satellite derived fire burn areas
- Energy Information Administration (EIA) annual fuel usage statistics
- EPA's Emission Inventory Improvement Program (EIIP)
- Missouri air-permitted sources

The activity data, emission factors, and control assumptions for each specific data category are outlined in Section 8. Many of the nonpoint emission categories are developed by EPA using nationally available datasets to ensure complete and consistent estimates. Those estimates are reviewed by states for accuracy of appropriateness of calculation methods, verification of input data, state-specific data input, and full geographic, temporal, and pollutant coverage. While most data is handled in Microsoft Excel or Access databases, some categories require the use of proprietary tools such as the SMARTFIRE program or Fredonia market research for solvent usage statistics. All data and documentation provided by EPA is stored electronically by Missouri. For nonpoint data categories where Missouri provides no state-specific data updates or corrections, EPA is notified that their estimate is accepted by Missouri.

6.3 Onroad Mobile

Onroad mobile data inputs include vehicle mile travelled estimates from travel planning organizations at the state and regional level. Vehicle registration data from the Missouri Department of Revenue include Vehicle Identification Numbers (VINs) that are decoded by a third-party vendor to determine the number, age, and engine types of vehicles on Missouri roads. Data from the Gateway Vehicle Inspection program is used to verify the number of inspection waivers given, retesting rate, and the pass/fail rate of inspections to ensure the amount of pollutant reduction attributed to vehicle maintenance is accounted for. All these datasets are formatted for use in EPA's approved mobile source model, the Motor Vehicle Emission Simulator (MOVES). The datasets are collected in electronic formats, manipulated

electronically, and stored in MOVES table structures that allow for appropriate model runs and data submittal to EPA.

6.4 Nonroad Mobile

EPA's NONROAD model, version 2008, is used to estimate emissions from engines that are not operated on roadways. Missouri does not collect state-specific engine or vehicle population or activity data for this category of model inputs. EPA's default NONROAD emissions are accepted by Missouri after a review of their results.

Nonroad emissions from aircraft, railroads, and commercial marine vehicles are not included in the NONROAD model.

- Aircraft emission data is estimated by EPA based on Federal Aviation Administration (FAA) airport-specific activity data that is input to the Emissions Dispersion Modeling System (EDMS) to provide emission calculations. EPA provides the input activity data to states for review and comment electronically, and provides the output emissions for review by states. Missouri had no comments on the estimates, and EPA's estimate for this category was accepted.
- Railroad emission data is estimated by EPA by scaling the 2008 emission estimates to 2011 based on the ratio of 2008 to 2011 freight hauled and revenue for large, Class I railroads, and by employee hours for smaller railroads. EPA only provided documentation of how the emissions were grown, and no review of the underlying electronic datasets was done by Missouri. EPA's estimate was for this category was accepted.
- Commercial marine operations were estimated by EPA using emissions developed in 2002 and grown to 2011, accounting for industry growth and updated engine standards. Missouri did not provide state-specific estimates, and reviewed EPA's estimates as they were provided in spreadsheet form. Missouri noted the large decrease in emissions due to an updated EPA procedure to allocate more emissions to underway activities compared to port activities. Missouri accepted this new estimation technique and emissions.

7.0 Point Source Inventory

7.1 Quality Assurance Prioritization

The Data Management Unit prioritizes review of facilities that produce the most emissions, specifically facilities with a Part 70 or Intermediate operating permit. While every data element collected helps to characterize the emission estimate, the fields most directly tied to the emissions calculation are given the highest priority.

7.2 Quality Assurance Methods

The Data Management Unit's general quality assurance (QA) procedures utilize many of the techniques outlined in the EPA's Emission Inventory Improvement Program (EIIP) Technical Report Series Volume 6: Quality Assurance Procedures. The unit groups these techniques into two basic categories: Bottom-Up QA procedures and Top-Down QA procedures. Top-Down Procedures analyze groups of emissions data that share a common trait and look for outliers, in keeping with the 'Reality Check' technique. Bottom-Up procedures evaluate individual EIQs that are believed to be erroneous due to data entry errors or inconsistencies brought up by a third party. The Air Quality Analysis unit's quality assurance efforts are driven by top-down techniques, with individual EIQ improvements due to referrals from other air program staff. This allows prioritization of potential errors found and maximizes the results achievable with the available staff resources. Correction of individual reports is done based on the results of the top-down and referral reviews.

Top-down quality assurance activities begin by determining what information to pull from the MoEIS database. The lists below give the Microsoft Access queries written to identify errors, prioritize facilities, and show totals for the year. The following section describes the results of data checks that resulted in changes to facility information or emissions.

EIQ Submission (queries named "Sub")		EIQ sources covered
Sub01	EIQ submittal no production and insignificant plant-wide	All - full and reduced
Sub02	Stats on number of Reduced doing Full	All - full and reduced
Sub03	Identify reduced sites to contact to verify 5 ton trigger	Reduced
Sub04	List of permits issued versus reduced doing full	All - full and reduced
Sub05	Stats on dates EIQs received	All - full and reduced
Sub06	Comments submitted	All - full and reduced
Sub07	MoEIS usage statistics	Full
Sub08	Identify confidential EIQs	Full
Sub09	Habitual late EIQs by permit and industry type	All - full and reduced
Sub10	Number of late EIQs	All - full and reduced
Sub11	Number of EIQs not sending signed 1.0 on time	All - full and reduced
Sub12	Pull 82 hardcopy full reports to get consultant name and	Full

	excel vs PDF	

EIQ Data Format for EIS Submittal (queries named "EIS")		EIQ sources covered
EIS01	Check MoEIS vs EIS code tables for active codes	N/A
EIS02	Submitting new data elements	NEI P70 and INT list
EIS03	Add unit type codes for new units	NEI P70 and INT list
EIS04	Existing processes to new release point	NEI P70 and INT list
EIS05	Fill in TRI-IDs	All - full and reduced

Common Data Errors in MoEIS (queries named "Err")		EIQ sources covered
Err01	Check PM_{10} always greater than $PM_{2.5}$	NEI P70 and INT list
Err02	Insignificant units with throughput greater than zero	Full
Err03	Ash/sulfur content not in the emission factor	NEI P70 and INT list
Err04	Check the MoEIS emission calculation is correct	All - full and reduced
Err05	If reduced doing full, make sure throughputs were updated	Full
Err06	Check that HAP worksheets were updated	Full
Err07	Clean up fuel combustion worksheet heat content and MHDR outliers	All - full and reduced
Err08	If only PM_{10} (no $PM_{2.5}$), list sources with over 10 tons	NEI P70 and INT list
Err09	Check that combustion SCCs are reporting all combustion CAPs	Full
Err10	Missing ozone worksheets need to be added	All - full and reduced
HAP Process to Worksheet	HAP amounts that differ between worksheets and emission calculations	NEI P70 and INT list
HAPs Without Worksheets	HAPs reported with no worksheet	NEI P70 and INT list

Financial (queries named "Fin")		EIQ sources covered
Fin01	Total Emission fees received	All - full and reduced
Fin02	Compare 2010 and 2011 fees received	All - full and reduced

Fin03	Compare local agency fees	All - full and reduced

Total Statewide Emissions (queries named "Tot")		EIQ sources covered
Tot01	Graph P70 emissions by pollutant over last 5 years	P70
Tot02	Graph INT emissions by pollutant over last 5 years	INT
Tot03	Graph all other permit types by pollutant over last five years	Basic, Dempal & PORT
Tot04	Graph total Missouri emissions over last 5 years	All

Compare to other data sets (queries named "Ext")		EIQ sources covered
Ext01	Retrieve CAMD data and compare to MoEIS for utilities	Electric Generating Units (EGUs)
Ext02	Retrieve EIA data and compare facility layout and ash/sulf and heat cont	EGUs
Ext03	Retrieve TRI air emissions and compare to MoEIS	Full
Ext04	Compare HAP contact list from Feb 2012 to see if problems were corrected	Previous list
Ext05	Compare to emission projection spreadsheet	Large Source List
Ext06	EPA 2008 NEI Priority and pollutant addition list	NEI P70 and INT list

Emission Checks by Industry (queries named "Ind")		EIQ sources covered
Ind01	For common NAICS groups, find outliers in emissions	Full
Ind02	For common NAICS groups, run emission trends last 5 years	NEI P70 and INT list
Ind03	For elec utilities, check that PM CON is reported separately	EGUs
Ind04	Other facilities where PM CON is speciated/should be	NEI P70 and INT list

Emission Checks by facility (queries named "Fac")		EIQ sources covered
Fac01	Total facility chargeable emission change >20% and >5 tons	Full
Fac02	Total facility pollutant change >20% and >5 tons	Full
Fac03	By pollutant and process, emission changes >20% and >5 tons	Full
Fac04	High priority pollutant and process changes of >10% and >3 tons	NEI P70 and INT list

Emission Factor Checks (queries named "Ef")		EIQ sources covered
Ef01	Source of factor AP-42, compare to webfire for same SCC	NEI P70 and INT list
Ef02	Stack test or eng calc factor changes 2010 to 2011	NEI P70 and INT list
Ef03	Review stack test letters from APCP Enf staff	All - full and reduced
Ef04	EPA revised PM Efs for gas combustion	All - full and reduced

Pollutant Checks (queries named "Pol")		EIQ sources covered
Pol01	Review Lead emissions over 0.25 ton in 2011 compared to 2010	All - full and reduced
Pol02	Identify the largest facilities for NH_3, see if any major sources are missing	All - full and reduced
Pol03	Check for total HAPs reported over the VOC/PM_{10} total	Fulls

7.3 Data Checks Used

Submission Checks

These queries provide statistics for the 2011 EIQ submissions, and they do not result in changes in reported emissions.

EIS Checks

These checks ensure that Missouri's emission inventory data can be properly mapped over to EPA's EIS data formats. These checks do not result in changes to reported emissions.

Err01

This data check was performed to identify facilities reporting $PM_{2.5}$ in excess of PM_{10} and those reporting PM_{10} with no $PM_{2.5}$. Since $PM_{2.5}$ is a component of PM_{10}, emissions of $PM_{2.5}$ must be less than or equal to emissions of PM_{10}. Only one facility reported less PM_{10} than $PM_{2.5}$, and the issue was corrected after a review of the facility's data.

Err02

This check identified units marked "insignificant", but where throughput was reported along with emissions. These units were simply changed from "insignificant" to "active" status, with no change in emissions.

Err03

This check identified the AP-42 emission factors that are the result of an equation involving either an ash or sulfur term. The SCCs associated with these factors were identified. It appears all facilities were correctly including the ash or sulfur term in the emission factor, and no changes were necessary.

Err04

Manual recalculation of the emission totals for all pollutants and emission processes verified that the MoEIS-generated emissions are correct.

Err05

For any facility choosing to do a full EIQ instead of a reduced EIQ, this check verifies that they updated one or more of their emission unit totals. No facilities were updated due to this check as they all updated their data to the current year.

Err06

HAP worksheet data tends to be overlooked during facility submittals, so this check ensures that the worksheet has been updated from the previous submittal. See Section 7.4 for more details.

Err07

Fuel combustion worksheets were examined to ensure that the heat content of the fuel was correct, given the unit of measure reported. Many worksheets were updated to ensure the proper heat content was reported, which in turn updated the maximum hourly design rate of the equipment. These changes did not result in changes to emission totals.

Err08

This data check was done to identify facilities reporting PM_{10} without reporting any $PM_{2.5}$. Nine facilities reported over ten tons PM_{10} emissions with no corresponding $PM_{2.5}$ emissions. These facilities were contacted, and $PM_{2.5}$ emissions were added to their updated report.

Err09

This data check ensured that all combustion pollutants were reported for an emission unit. The data showed that nine facilities were missing at least one expected combustion pollutant for at least one unit, and the resulting new pollutants and emissions were saved via revised emission reports.

Err10

Facilities in the five-county St. Louis Ozone Nonattainment area were identified if they were missing the Ozone Season Worksheet that estimates emissions of CO, NO_x, and VOC on a typical summer day. Several facilities had this worksheet added to their report since it is estimated based on data elements found elsewhere in their report, and this additional worksheet did not change any reported annual emission totals.

HAP Process to Worksheet

This check determines which facilities have a discrepancy between the amount of HAPs reported as HAPs on worksheets and the total chargeable HAPs for 2011. See Section 7.4 for more details.

HAPs Without Worksheets

For a facility that reported over 5 tons of total HAPs, emissions were reviewed if they did not itemize emissions on the HAP worksheet. See Section 7.4 for more details.

Financial Checks

These checks tabulate emission fees that are based on reported emissions. These checks do not result in changes to reported emissions.

Total Checks

The emission total checks create graphical displays of aggregate emission trends, and do not result in reported emission changes.

Ext01

EPA's Clean Air Markets Division (CAMD) emissions data for electric generating units was compared to emissions reported to Missouri. Since these emissions are measured by continuous emissions monitors (CEMs) at the facility, and results transmitted directly to EPA, the same emissions should be reported to Missouri. Any facility with over a 20% and 5 tons difference in either NO_x or SO_x emissions was flagged for review. The four facilities that showed at least one unit meeting the review threshold reported their facility total emissions in agreement between the two systems, but the grouping of emission units differed between CAMD and MoEIS. No changes were made to emission reports since there was no net difference in emission totals.

Ext02

The Energy Information Administration (EIA) Form 860 and Form 923 data was compared to emission reports from electric generating units to ensure consistency between control devices and ash and sulfur content of fuels. Due to time constraints, this comparison was not completed.

Ext03

The 2011 Toxics Release Inventory (TRI) dataset for Missouri was compared to EIQ data. See Section 7.4 for more details.

Ext04

Facilities that had problem HAP reporting for 2010 were reviewed to ensure that problems weren't repeated in 2011. See Section 7.4 for more details.

Ext05

Missouri maintains an emission projection spreadsheet that gives estimates for facilities expected to shut down, add controls, or otherwise reduce emissions, in future years. The spreadsheet was reviewed to ensure expected emission changes were seen in reported data. Two facilities that significantly reduced emissions due to shutdowns during 2011 were verified by the comparison, and one facility that stopped using coal for a combustion process was also verified.

Ext06

Based on the 2008 NEI facility priority list shared by EPA with the states, Missouri pulled their 2011 data to see if there were significant changes, additions, or deletions that would be noted by EPA. While some of these facilities showed large changes in both CAP and HAP emissions, the changing nature of EPA's priorities from 2008 to 2011 made detailed analysis of these facilities unnecessary. Changes in facility emissions over time were examined in further quality assurance checks.

Ind01

Emission outliers were to be examined by industry types. Due to time constrains, this check was not completed.

Ind02

These checks create emission trend graphics for common industry types. These graphics do not cause changes to reported emissions.

Ind03

For electric utilities, Missouri had worked with them to adjust previous year emission reports to include condensable PM for coal combustion units. A check of their 2011 data showed those units were still reporting PM CON.

Ind04

For non-EGU facilities that EPA created PM CON emissions in the 2008 NEI, their 2011 emission reports to Missouri were reviewed to see if they should be itemizing PM CON. No facility reports were amended as a result of this comparison, as most large combustion units had begun itemizing PM CON in their reports.

Fac01
The initial goal of examining facilities with changes of 20% or 5 tons produced over 100 facilities of interest. Instead, 51 facilities with total chargeable emissions change of 30% and 15 tons from 2010 to 2011 were examined. Several changes are attributed to facility shutdowns or equipment changes, and most other changes are legitimately due to changes in activity levels at the facility. No erroneous facility total emission changes were identified.

Fac02
Facility-total pollutants PM_{10}, NO_X, SO_x, and VOC were examined for single-pollutant changes that drove emission changes from 2010 to 2011. To reduce the list from over 100 facilities to 39, only changes of 30% and 15 tons were examined. Many facilities on this list overlapped the Fac01 results, meaning facility process and production changes created the emission changes. No erroneous facility pollutant total changes were identified.

Fac03
For specific pollutants and processes, changes of 20% and 5 tons were initially reviewed to try and identify erroneous changes in throughput, emission factors, or control efficiencies. Due to the large number of records and processes involved, plus the overlap of facilities from checks Fac01 and Fac02, no emission changes at the process level were identified for detailed investigation or modification.

Fac04
For a select group of sources, the check was to identify process-specific pollutant changes of 10% or more than 3 tons. Due to the overlap of checks from the previous series of checks, and the number of processes involved, this check was not completed.

EF01
For emission factors where the source is cited as AP-42, this check attempts to verify that the emission factor is accurate. Since the webFIRE database should contain SCC-specific emission factor from AP-42, the database was compared to MoEIS emission factors for the same SCC, pollutant, and control status. One common problem with this approach is that the SCC chosen by a facility to describe an emission process should match closely to what is actually occurring, and the emission factor may not be associated with that same SCC. For cases where a facility has chosen an emission factor from a similar process, but not the exact process SCC, it becomes difficult to separate these legitimate emission factors from poorly chosen or misrepresented emission factors. No updates were made to emission factors based on this comparison. Future work with AP-42 emission factor verification will be industry and process specific to ensure groups of similar equipment are estimating emissions consistently, regardless of the source of emission factor.

EF02

For stack test factors that have changed between the 2010 and 2011 reports, the air program enforcement approved stack tests done during 2010 and 2011 were reviewed to ensure the facility used the most current test, and applied the factor correctly. The review found no concerns with the modified stack tested emission factors, and no updated emission reports were needed.

EF03

Similar to the previous check, all program reviewed and approved stack tests were examined to ensure the facility used the most recent tested emission factors, regardless of how their previous emission reports may have appeared. No updated emission reports were needed based on this check.

EF04

EPA proposed that updated emission factors for PM from natural gas combustion be considered by states prior to inventory submittal. EPA based these new factors on more recent stack tests done with an updated stack test method. Missouri data indicates that the majority of PM emission factors EPA proposes to update will result in less than a ton of emission change, and many of Missouri's large PM natural gas sources are already using site-specific emission factors. Though EPA claims these factors are higher quality than what exists in AP-42, there has not been an open opportunity for states and local agencies to review the proposed new factors. Despite the small change in PM that could result from Missouri using EPA's proposed factors, Missouri will wait for EPA to fully incorporate these updated factors to the AP-42 documents, including offering the results for state and local agency review.

Pol01

The lead monitoring network in Missouri covers all sources estimating over 0.5 tons of emissions annually, except for sources with model-demonstrated ambient impacts below the level of the standard. For Missouri, an annual review of all sources emitting over 0.5 tons of lead is completed, and 0.25 ton sources are also reviewed to ensure complete coverage of the network. All sources previously identified in 2008 through 2010 data continued reporting emissions at or above the 0.25 ton level, including power plants, lead smelters, ammunition plants, and large coal-fired boilers. This review did not result in any revised emission reports.

Pol02

The largest sources of ammonia were identified in the inventory, and all facilities in those industries were reviewed to ensure the pollutant is being included where necessary. The largest emitters are power plants with urea injection as part of a NO_x control strategy, and wastewater treatment plants. A review of facilities in these industries shows all are reporting ammonia emissions as expected, and no revised emission reports were required.

Pol03

For facilities reporting aggregate and itemized HAP pollutants, this check ensures that the HAPs are a subset of their total PM_{10} or VOC emissions, and HAPs are not greater than the PM_{10} and VOC totals. See section 7.4 for further details.

7.4 Quality Assurance of Hazardous Air Pollutant emissions

Various quality assurance checks were performed on Hazardous Air Pollutant (HAP) data reported by facilities with a Part 70 or Intermediate operating permit. The data was investigated in a different manner than the previous year. For the 2010 reporting year, facilities were marked high priority primarily because of large differences in amounts reported from 2009 to 2010. That approach yielded some positive results, but proved to be very time intensive. Additionally, sites reporting large year to year changes were often correct. A modified approach was developed, and HAP data checks performed for the 2011 reporting year fall under these general categories:

- Searches for data that cannot be correct, such as grouped HAPs reported in the fee calculations with no speciated HAP worksheets present
- Searches for data that is unlikely to be correct, such as identical HAP emissions from 2010 to 2011
- Cross-checks with other data sources, primarily the Toxic Release Inventory (TRI)

More specifically, the following checks were done to identify HAP areas of concern.

<u>Err06</u>

Data check Err06 compared hazardous air pollutant (HAP) worksheets to find those that were not updated between reporting years 2011 and 2012. Two Access queries were used to extract the necessary information, one for 2010 data and one for 2011 data. Facilities with identical information on both year's worksheets were identified, and any site with five or more tons of HAPs was marked high priority.

<u>Ext01</u>

Data check Ext01 compared SO_x and NO_x data submitted through MoEIS to data submitted directly to EPA. Some electricity generating facilities are required to use continuous emission monitoring to demonstrate compliance with the Acid Rain Program. This information is available online from EPA. Discrepancies exceeding five tons and twenty percent of total emissions were identified and marked high priority.

<u>Ext03</u>

Data check Ext03 compared HAP data submitted to the emissions inventory to submissions made to the Toxic Release Inventory (TRI). Since there is a significant amount of overlap between the two, most comparisons can be made on a chemical by chemical basis. EPA typically releases preliminary TRI data within a month of the July 1 due date. MoEIS stores TRI identification numbers for point sources,

allowing a facility-total match between the two data sets. This comparison used releases reported to the TRI as Fugitive Air and Stack Air. No other TRI data was used.

Two facilities reported hazardous air pollutants to the TRI but not to the EIQ. Both were marked high priority and investigated. One facility appeared to have TRI emissions below the EIQ reporting threshold. Hazardous air pollutants were added to the other facility's report.

Ext04

Facilities that reported identical HAP worksheets for years 2009 and 2010, had HAP worksheets that didn't match the total chargeable HAP tons, or had significant differences between TRI and EIQ data were identified in early 2012. These facilities received an email explaining the potential errors and advising them that particular attention should be paid to these areas of the inventory for the 2011 reporting year. Data check Ext04 rechecked the facilities with HAPs reported on worksheets that did not match chargeable HAPs and determine if the same mistake was made again for 2011. The purpose for this step was not to identify facilities to contact, but to determine the effectiveness of using mass email as a means to improve the inventory. The QA plan already included checks for identical HAP worksheets and concurrent with TRI data.

Ext06

In May, 2012, EPA sent a spreadsheet containing 2008 NEI data to the department with pollutants that EPA considers particularly significant. Some of the emission quantities that were ultimately used by EPA in the NEI were different than what was reported by the department. Four Access queries were written to compare the data used by EPA to the data that was submitted by the department to the 2008 NEI. The first query, Ext06a, extracted the amount of each of the ten HAPs on EPA's list that the department reported as VOC or PM_{10} in 2008 for each facility on the 2011 NEI submission list. The second query, Ext06b, contained the HAPs reported in 2008 as HAPs. The third query, Ext06c, combined HAPs reported by the department as VOC or PM_{10} and HAPs reported as HAPs into one table. As part of data check Ext06, the HAPs for each facility on EPA's list were converted into an Access table. The last query, Ext06final, combined HAPs reported by the department for the 2008 NEI and the HAPs from EPA's list into one table.

A comparison of the two data sets revealed widespread and significant differences. Since addressing the discrepancies would have taken a vast amount of time, and since the data is several years old, it was decided not to pursue corrections except in the very worst case. The pollutants on the EPA list will be given special attention in another QA step, Ext03.

Pol03

Data check Pol03 compares the amount of HAPs reported as VOC or PM_{10} to the total amount of VOC and PM_{10} reported for the. An Access query, Pol03a, reports the total amounts of VOC and PM_{10} claimed at each site. A second query, Pol03b reports the total amount of HAPs reported as VOC and PM_{10} on the site's HAP worksheets. Pol3final matches the HAPs VOC and PM_{10} and total VOC and PM_{10}

by facility for comparison. Any site reporting HAPs as VOC or PM_{10} in excess of the total VOC and PM_{10} reported was noted as an error. Facilities with an excess of five tons or more were added to the high priority list.

HAP Process to Worksheet Check

Although not included in the original list of QA steps, this check was done to determine which facilities have a discrepancy between the amount of HAPs reported as HAPs on worksheets and the total chargeable HAPs for 2011. A single query, titled HAP Process to Worksheet Check, compared the two amounts. Nine facilities with a difference of five or more tons were added to the high priority list.

HAPs Without Worksheets Check

This step was also a later addition to the original QA plan. It determined which facilities reported HAPs as chargeable tons but did not have any HAP worksheets. An Access query extracted the sum of HAPs from the HAP worksheets and the sum of chargeable HAPs. The join properties were set in such a way that any facility with chargeable HAPs would be included, even if no worksheets exist. When including summations from multiple tables, Access often reports erroneous information. In this case, chargeable tons, when present, were frequently inaccurate. For any site with chargeable HAPs and no blank worksheet values, DNR staff verified the actual chargeable tons through the MoEIS website. Any facility with no HAP worksheets and five or more tons of chargeable HAPs was added to the high priority list.

After the high priority list was compiled, a detailed review was done to remove facilities that were likely correct or would not significantly impact the inventory if corrected. A total of five facilities were removed for the following reasons.

- Data for 2011 had not been submitted, and APCP staff was working with the site to get updated information.
- HAP emissions for 2010 and 2011 were identical, but other emissions were nearly identical. One site had a year to year difference of 2.6%, and another had a difference of less than 1%.
- There was no production in 2011, and the site had no operating permit.
- The company's consultant verified that 2011 data was accurate, and said that the mistake was in the 2010 data that was used for comparison.

After the preliminary review, the high priority list contained 22 facilities. Contact was made with each facility, and any reporting errors were resolved. Changes made to the inventory were documented in the facility's 2011 EIQ file.

Table 2: Point Source Emissions by Facility (tons per year)

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
001	0006	AMEREN MISSOURI	0.15			0.59	0.03	0.00	0.00	0.03
003	P011	KELLER CONSTRUCTION COMPANY	6.63	0.00		0.41	2.04	0.23	0.08	0.14
007	0001	MID AMERICA BRICK	8.81			2.57	3.85	0.09	4.72	0.50
007	0002	ARCHER DANIELS MIDLAND CO	15.13			18.01	45.04	18.79	0.11	79.47
007	0003	HARBISON-WALKER REFRACTORIES	16.77			6.55	16.94	11.84	11.74	0.63
007	0012	AMEREN MISSOURI	0.01	0.00		2.36	0.03	0.03	2.71	0.00
007	0040	TEVA PHARMACEUTICALS USA INC	0.39	0.00	0.46	3.06	0.24	0.24	0.02	6.73
007	0041	VANDALIA POWER PLANT	0.20			0.95	0.02	0.00	0.06	0.08
007	0047	CERRO FLOW PRODUCTS LLC	117.43	0.02	0.00	2.50	17.12	15.11	1.34	4.61
007	0051	MEXICO PLASTIC COMPANY	0.05			0.26	0.01	0.00	0.00	133.09
007	0053	AMEREN MISSOURI	32.93			56.02	6.21	0.00	0.36	1.15
007	0054	POET BIOREFINING	54.66			45.86	26.56	0.00	0.46	48.85
009	0003	EFCO	5.49		1.18	6.53	0.93	0.50	0.04	57.09
009	0005	SAPA EXTRUSIONS NORTH AMERICA	18.02	0.00	0.69	22.59	11.53	11.27	0.93	102.96
009	0021	SCHREIBER FOODS INC	6.73	0.00	0.26	8.01	0.61	0.61	0.05	0.44
009	0052	JUSTIN BOOT COMPANY	0.00			0.00	0.00	0.00	0.00	15.47
009	0062	ARCHITECTURAL SYSTEMS INC				4.57				24.02

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
009	0066	GEORGE'S INC	2.47		0.09	2.93	17.18	2.73	0.02	0.16
011	0031	LAMAR CITY ELECTRICAL GENERATION	118.81			39.11	5.10	5.10	1.70	8.24
011	0039	PRAIRIE VIEW REGIONAL WASTE FACILITY	43.85			2.34	11.03	2.00	0.82	4.92
013	0029	BUTLER MUNICIPAL POWER PLANT	0.23			2.23	0.19	0.19	0.63	0.06
017	0019	NATURAL GAS PIPELINE COMPANY	185.46		0.00	2,924.24	31.83	31.83	0.39	79.11
019	0002	COLUMBIA MUNICIPAL POWER PLANT	129.33	0.00	10.91	266.32	23.31	21.58	1,044.81	1.88
019	0004	UNIVERSITY OF MISSOURI (MU)	70.05	0.00	0.06	500.43	60.52	56.07	5,925.66	3.39
019	0005	MAGELLAN PIPELINE COMPANY LP	8.45			3.38				30.79
019	0039	HUBBELL POWER SYSTEMS, INC	4.75	0.01	0.00	6.79	4.93	0.24	0.07	20.15
019	0045	CHRISTIAN HEALTH SYSTEMS	2.78	0.00	0.02	5.03	0.37	0.36	0.55	0.33
019	0047	UNIVERSITY OF MISSOURI	0.30	0.00	0.01	1.38	0.03	0.03	0.09	2.78
019	0066	DANA LIGHT VEHICLE DRIVELINE	0.33		0.01	0.40	0.03	0.03	0.00	3.86
019	0069	QUAKER MANUFACTURING LLC	0.92			1.09	13.33	13.33	0.01	49.47
019	0077	PANHANDLE EASTERN PIPELINE	151.43			641.84	12.34	12.34	1.85	45.64
019	0091	COLUMBIA SANITARY LANDFILL	96.78	0.00		12.67	5.35	0.70	2.34	1.54
019	0105	COLUMBIA ENERGY CENTER	2.31	0.00		3.20	0.68	0.12	0.04	0.37
021	0004	KANSAS CITY POWER AND LIGHT CO	117.70	0.08	2.33	2,335.74	357.12	110.48	1,925.60	21.09
021	0009	JOHNSON CONTROLS BATTERY GROUP INC	5.65	0.19		6.73	7.37	4.02	0.40	0.44

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
021	0016	LIFE LINE FOODS LLC	37.85			36.81	12.01	3.12	40.55	19.58
021	0037	ALBAUGH INC					0.00	0.00		34.99
021	0045	OMNIUM LLC	0.00			0.00	4.67	0.00	0.00	0.00
021	0046	INTERNATIONAL PAPER	4.03		0.15	4.80	0.37	0.27	0.03	3.90
021	0056	BARTLETT GRAIN COMPANY LP	1.31	0.00		1.56	12.89	1.30	0.01	0.09
021	0060	AG PROCESSING INC	1.44			1.71	35.43	10.41	0.01	270.79
021	0063	HEARTLAND REGIONAL MEDICAL CENTER EAST	5.25	0.00	0.03	6.27	0.48	0.48	0.04	0.34
021	0064	SILGAN CONTAINERS CORP	5.80	0.00		6.90	0.52	0.52	0.04	23.28
021	0078	ALTEC INDUSTRIES INC	1.98	0.01	0.08	2.37	0.85	0.44	0.07	28.67
021	0095	BLUESCOPE BUILDINGS	0.00			0.00	0.00	0.00		92.15
021	0105	ST. JOSEPH LANDFILL	29.89			1.59	12.88	1.22	0.56	7.34
021	0118	AG PROCESSING					0.49	0.00		3.18
021	0129	KANSAS CITY POWER AND LIGHT CO	20.08			1.07	0.46	0.46	0.37	0.01
023	0003	WILLIAMSVILLE MATERIALS					5.69	0.01		0.00
023	0027	JOHN J. PERSHING VA MEDICAL CENTER	1.28		0.07	4.33	0.15	0.12	0.51	0.09
023	0032	GATES CORPORATION	4.38	0.00		5.22	0.40	0.00	0.03	19.70
023	0038	BRIGGS AND STRATTON CORP	29.05	0.00	0.04	7.89	8.20	0.41	0.35	70.12
023	0042	CENTERPOINT ENERGY	111.49			108.08	1.51	1.51	0.03	5.30
023	0050	POPLAR BLUFF MUNICIPAL UTILITIES	2.71		0.09	9.94	0.15	0.14	0.13	0.56

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
023	0058	BUTLER COUNTY LANDFILL	47.25			2.52	1.07	1.07	0.88	1.63
023	0062	NORDYNE LLC	0.01			0.02	0.00	0.00	0.00	42.57
027	0001	HARBISON-WALKER REFRACTORIES	0.08			0.09	0.86	0.03	0.00	0.01
027	0007	FULTON POWER PLANT	0.32		0.10	1.38	0.05	0.04	0.03	0.06
027	0010	A. P. GREEN INDUSTRIES INC	25.22			7.39	25.71	14.21	16.37	0.51
027	0019	ABB INC	4.02			5.98	2.13	0.00	0.04	69.85
027	0026	AMEREN MISSOURI	4.12			20.59	0.59	0.00	5.00	0.66
031	0002	DELTA ASPHALT INC	37.45	0.00	0.69	2.33	5.29	0.20	0.21	1.92
031	0010	SOUTHEAST MISSOURI STATE UNIVERSITY	33.00	0.00	0.00	41.25	9.02	6.05	418.00	0.28
031	0021	BUZZI UNICEM USA	7,113.12	0.00	12.69	1,129.35	393.86	218.29	331.95	242.00
031	0053	PROCTER AND GAMBLE PAPER PRODUCTS CO	185.84	0.00	1.55	101.53	49.72	0.51	1.01	248.84
031	0058	ST. FRANCIS MEDICAL CENTER	5.01		0.04	6.89	0.46	0.46	0.14	0.44
031	0061	JACKSON MUNICIPAL UTILITIES	0.36			1.35	0.02	0.02	0.00	0.04
031	0064	BIOKYOWA INC	18.89	0.00	4.81	8.39	2.57	1.71	1.15	9.31
031	0072	MONDI JACKSON	0.66			1.15	2.10	2.10	0.09	18.24
031	0081	CONSOLIDATED GRAIN AND BARGE CO					0.58	0.00		
031	0126	MID-SOUTH PRODUCTS INC					0.23	0.02		4.55
033	0001	SINCLAIR	3.25			1.30				74.56
033	0013	AGRISERVICES OF BRUNSWICK LLC WEST	0.02		0.02	0.10	15.15	1.12	0.00	0.00

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
033	0022	CARROLLTON MUNICIPAL UTILITIES	2.00		0.06	10.88	0.18	0.18	0.42	7.46
033	0023	RAY-CARROLL COUNTY GRAIN GROWERS INC	0.00			0.00	4.21	0.00	0.00	0.00
033	0036	SHOW ME ETHANOL LLC	29.26			48.74	12.76	0.00	0.97	15.11
033	0037	RAY-CARROLL FUELS								0.70
035	0004	ROYAL OAK ENTERPRISES	29.19			70.20	16.01	5.15		4.19
037	0001	MARTIN MARIETTA MATERIALS					55.41	4.45		
037	0002	MARTIN MARIETTA MATERIALS LLC					1.87	0.00		
037	0003	KANSAS CITY POWER AND LIGHT CO	0.31			3.02	0.07	0.07	0.01	0.02
037	0048	PECULIAR SOUTHERN STAR CENTRAL	4.87		0.00	36.22	0.73	0.58	0.00	20.11
037	0056	DOGWOOD ENERGY FACILITY	6.08		13.89	43.24	19.82	19.82	0.29	3.18
037	0063	KANSAS CITY POWER AND LIGHT CO	39.38			24.31	3.17	3.17	0.29	1.01
039	0003	DAIRICONCEPTS	9.12	0.00	0.35	7.92	38.17	38.04	0.07	0.60
039	0012	FOAM FABRICATORS INC	1.55		0.06	1.84	0.14	0.10	0.01	30.75
045	0026	KAHOKA ELECTRIC GENERATING PLANT	0.05			0.21	0.00	0.00	0.06	0.21
045	0028	KPF STEEL FOUNDRY	0.37		0.00	0.50	1.71	0.03	0.00	1.00
047	0002	INGREDION, INC	26.86			31.98	108.85	0.34	72.97	70.91
047	0009	ARCHER DANIELS MIDLAND CO	0.51	0.00	0.02	0.61	11.15	0.90	0.00	0.03
047	0012	CCP COMPOSITES US LLC	2.41	0.00	0.09	3.09	0.53	0.22	0.02	0.70

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
047	0019	FORD MOTOR CO	68.56	0.00	2.61	81.79	78.67	74.56	0.51	1,529.78
047	0025	BARTLETT GRAIN COMPANY					2.64	0.13		
047	0027	CARGILL INC				0.04	0.38	0.00	0.00	0.00
047	0032	HENRY WURST INC	0.06			1.53	0.01	0.00	0.00	22.87
047	0040	DAVIS PAINT CO	0.03			0.08	5.63	0.00	0.00	4.30
047	0052	AXEL AMERICAS, LLC	0.10			0.41	0.01	0.00	0.00	0.01
047	0059	HALLMARK CARDS INC	1.52	0.00		1.81	0.14	0.00	0.01	0.10
047	0075	TNEMEC COMPANY INC	0.00		0.00	0.00	0.22	0.00	0.00	14.53
047	0096	INDEPENDENCE POWER AND LIGHT	9.73	0.01	0.05	588.33	130.19	123.37	2,136.06	0.77
047	0122	RR DONNELLEY	1.29		0.00	1.54	0.18	0.00	0.01	23.33
047	0141	FUJIFILM MANUFACTURING USA INC	0.07			0.32	0.02	0.00	0.00	32.23
047	0175	VERTEX PLASTICS INC								0.40
047	0189	ARKEMA INC	0.51			0.85	1.51	0.05	0.00	0.78
047	2227	WATER SUPPLY DIVISION	6.97	0.00	0.23	15.72	9.01	0.60	0.13	0.71
051	0008	AMEREN MISSOURI	0.08	0.00		1.15	0.06	0.00	1.66	0.03
051	0009	UNILEVER SUPPLY CHAIN INC.	3.92			4.66	0.35	0.35	0.03	0.41
051	0028	RR DONNELLEY-JEFFERSON CITY								33.08
051	0032	MODINE MANUFACTURING COMPANY	2.51	0.08	0.10	3.03	4.47	3.17	0.02	20.03
051	0042	PHILLIPS 66 PIPELINE COMPANY	44.19			25.31				26.47

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
051	0043	COMMAND WEB OFFSET MISSOURI INC	0.55			0.65	0.05	0.05	0.00	21.58
051	0049	AMEREN MISSOURI	0.07	0.00		1.07	0.06	0.00	1.54	0.03
051	0058	JEFFERSON CITY LANDFILL LLC	11.24			0.60	1.59	0.39	0.21	2.49
051	0075	AMERESCO JEFFERSON CITY LLC	94.42			21.42	5.52	0.00	1.74	4.68
053	0003	HUEBERT FIBERBOARD INC	61.86			22.84	17.26	0.00	2.57	1.79
053	0019	CATERPILLAR INC	1.23	0.02		1.47	1.71	0.12	0.01	8.73
053	0021	NORDYNE INC	0.18			0.22	0.03	0.00	0.00	5.62
053	0027	OFFICE OF ADMINISTRATION FMDC	2.53		0.10	0.97	0.23	0.23	0.15	0.17
055	0043	SLP LIGHTING CENTER								27.14
061	0010	LANDMARK MFG CORP	0.00		0.00	0.00	0.02	0.02	0.00	3.71
063	0009	MAGELLAN PIPELINE COMPANY LP	2.92			7.00	0.27	0.00	0.05	0.51
065	0038	ROYAL OAK ENTERPRISES INC	56.84	0.01	0.00	46.55	84.54	30.95	2.36	5.04
069	0010	WHITE OAK GIN COMPANY INC	0.63			0.75	8.39	0.25	0.00	0.04
069	0014	GRAVES KENNETT GIN COTTON CO INC	0.13			0.16	9.27	0.27	0.00	0.01
069	0018	FARMERS UNION GIN					31.08	0.91		
069	0027	FOUR WAY GIN COMPANY					17.71	0.38		
069	0029	CARDWELL COOPERATIVE INC					6.20	0.00		0.00
069	0034	MALDEN MUNICIPAL POWER & LIGHT	0.42		0.00	1.98	0.05	0.05	0.13	0.10

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
069	0063	KENNETT GENERATING PLANT	1.74	0.00		13.42	0.21	0.21	0.30	1.24
069	0066	ST FRANCIS POWER PLANT	32.04		26.25	46.75	11.87	0.26	1.83	5.55
071	0003	AMEREN MISSOURI	2,694.05	0.00	3.04	9,891.45	2,660.87	1,712.12	57,948.73	323.14
071	0014	CANAM STEEL CORP	0.01			1.45	0.44	0.00	0.00	40.51
071	0020	STEELWELD EQUIPMENT CO INC	0.10	0.00		0.12	0.01	0.00	0.00	4.10
071	0031	GRAPHIC PACKAGING INTERNATIONAL	0.04		0.03	0.18	0.02	0.02	0.00	27.80
071	0068	MERAMEC INDUSTRIES INC	0.06			0.27	1.11	0.00	0.00	42.21
071	0080	SPARTAN SHOWCASE INC	0.35			0.42	0.06	0.00	0.00	14.12
071	0087	BULL MOOSE TUBE COMPANY	0.28			0.48	0.65	0.09	0.00	26.06
071	0131	SULLIVAN PRECISION METAL FINISHING INC	0.00			0.00	0.00	0.00	0.00	4.23
071	0132	SPORLAN VALVE DIVSION								24.14
071	0151	AEROFIL TECHNOLOGY INC	0.26			1.28	5.77	2.31	0.01	46.92
071	0153	MAGNET LLC								9.15
071	0157	PLAZE INCORPORATED	0.25			1.20	0.04	0.00	0.01	52.13
071	0173	HENNIGES AUTOMOTIVE SEALING SYSTEMS NA				0.53			0.00	14.23
071	0230	PLAZE, INC	0.62			0.73	0.06	0.00	0.00	11.84
073	0008	RR DONNELLEY - OWENSVILLE	1.55		0.06	1.85	0.14	0.14	0.01	122.75
077	0004	CARLISLE POWER TRANSMISSION PRODUCTS INC	7.90	0.00	0.30	9.51	3.39	0.84	0.55	61.25

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
077	0005	CITY UTILITIES OF SPRINGFIELD MISSOURI	697.57	0.03	0.58	1,434.54	398.21	238.54	3,268.80	20.10
077	0008	BRISTOL MANUFACTURING CORP	0.27	0.00	0.01	2.15	0.16	0.02	0.01	23.70
077	0017	EUTICALS INC	1.55	0.00	0.14	6.20	1.78	0.70	0.38	6.71
077	0026	KRAFT FOODS GROUP INC	9.62	0.00	0.37	11.45	2.37	0.87	0.07	5.34
077	0028	MERCY HOSPITAL - SPRINGFIELD	12.37	0.00	0.46	11.32	1.14	1.14	0.38	1.11
077	0036	DAIRY FARMERS OF AMERICA INC	5.62	0.00	0.21	6.69	0.53	0.51	0.04	0.68
077	0039	CITY UTILITIES OF SPRINGFIELD MISSOURI	835.87	0.03	34.21	1,367.11	385.60	172.51	5,455.78	26.18
077	0047	MISSOURI STATE UNIVERSITY	6.19	0.00	0.04	7.37	0.56	0.56	0.04	0.41
077	0051	3M COMPANY	5.01	0.00	0.19	5.97	1.54	0.45	0.04	22.41
077	0116	MAGELLAN PIPELINE COMPANY LLC	16.72			6.69				41.65
077	0161	SPRINGFIELD SANITARY LANDFILL	176.32			9.40	25.00	1.47	3.29	2.32
077	0163	CITY UTILITIES OF SPRINGFIELD	0.08			0.25	0.02	0.01	0.02	0.02
077	0164	CITY UTILITIES OF SPRINGFIELD	14.59	0.00		15.11	0.57	0.57	0.08	0.40
077	0170	CITY UTILITIES OF SPRINGFIELD MISSOURI	95.42			20.74	5.39	5.39	2.11	0.00
077	0228	SUPERIOR SOLVENTS & CHEMICALS								2.84
079	0004	MODINE MANUFACTURING COMPANY	3.09		0.12	3.87	2.81	0.28	0.02	35.31
079	0027	TRENTON MUNICIPAL UTILITIES	0.51		0.00	1.92	0.03	0.03	0.61	0.07
081	0010	MAGELLAN PIPELINE COMPANY LP	14.75			35.41	1.38	0.00	0.26	2.60

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
081	0015	BETHANY MUNICIPAL POWER PLANT	0.53			2.47	0.05	0.05	0.01	0.18
083	0001	KANSAS CITY POWER AND LIGHT CO	409.27	0.09	0.86	4,701.55	367.39	199.92	10,998.22	48.91
083	0011	APAC MO, INC	0.64			0.68	13.16	0.02	1.49	0.47
083	0031	TRACKER MARINE	1.12			1.33	0.49	0.00	0.01	69.30
083	0033	SCHREIBER FOODS INC	0.35		0.01	0.41	0.03	0.03	0.00	19.11
083	0046	SCHREIBER FOODS INC	0.68		0.03	0.81	0.06	0.06	0.00	44.72
087	0001	EXIDE TECHNOLOGIES	3.10	0.01	0.12	7.01	20.24	20.24	92.14	105.00
087	0016	GOLDEN TRIANGLE ENERGY	0.36		1.07	10.11	43.95	4.16	0.37	49.50
091	0005	SMITH FLOORING COMPANY	31.87			26.03	9.93	3.19	1.33	0.92
091	0011	DRS SUSTAINMENT SYSTEMS INC.	0.15		0.10	0.75	0.41	0.02	0.03	23.66
091	0037	ROYAL OAK ENTERPRISES INC	25.70	0.00	0.00	20.99	51.57	11.44	1.07	2.21
091	0038	GARNETT WOOD PRODUCTS	2,413.94			142.85	106.77	68.32	0.00	934.40
091	0046	ARMSTRONG HARDWOOD FLOORING COMPANY	12.06			2.13	6.42	0.00	1.22	44.62
091	0068	CITY OF WEST PLAINS-POWER STATION	0.21		0.01	0.85	0.07	0.00	0.02	0.02
093	0005	DOE RUN COMPANY	0.00	1.07		0.00	51.47	7.71	0.00	2.32
093	0009	DOE RUN COMPANY	25,641.21	16.88		82.49	30.73	22.43	2,199.25	11.19
095	0002	BUCKEYE TANK TERMINALS, LLC	4.75			1.90				42.64
095	0005	U. S. DEPT OF ENERGY	0.85	0.00	0.88	13.98	0.55	0.53	0.19	8.34

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
095	0011	BAYER CROPSCIENCE	23.01	0.00	0.80	48.09	4.23	4.23	3.14	12.61
095	0012	CLAY AND BAILEY MFG CO	0.01	0.00		0.09	5.08	0.00	0.01	0.45
095	0017	FOLGERS COFFEE CO	140.02			20.95	10.79	0.00	7.01	35.23
095	0021	VEOLIA ENERGY KANSAS CITY INC	39.50	0.02	5.21	1,216.88	358.40	354.05	6,742.40	4.00
095	0022	KANSAS CITY POWER AND LIGHT CO	2,007.09	0.04	8.43	1,424.74	189.87	167.39	1,800.05	28.99
095	0023	KANSAS CITY POWER AND LIGHT CO	0.04	0.00		13.00	0.12	0.12	0.33	1.01
095	0026	HANSEN MUELLER KANSAS CITY ELEVATOR					0.11	0.02		
095	0030	AUDUBON MATERIALS, LLC	542.09	0.00	17.93	646.83	183.89	84.26	91.48	71.71
095	0031	KCP AND L - GREATER MO OPERATIONS	350.66	0.03	0.39	2,461.30	338.23	292.11	13,872.10	76.84
095	0037	VANCE BROTHERS INC	15.63	0.00	0.14	9.24	1.46	0.78	0.22	1.49
095	0039	BLUE RIVER TREATMENT PLANT	66.22	0.06	0.02	13.37	2.41	1.94	0.22	2.36
095	0046	ALLIANT TECHSYSTEMS INC	18.05	0.42	0.86	46.92	10.64	2.09	1.51	113.61
095	0050	INDEPENDENCE POWER AND LIGHT	24.31	0.02	0.14	525.04	305.45	271.00	4,969.73	3.54
095	0064	VANCE BROTHERS INC	0.40	0.00	0.14	4.46	0.69	0.37	0.03	0.25
095	0075	PETERSON MFG CO	0.41	0.00		0.48	0.08	0.03	0.00	1.03
095	0076	BARBER AND SONS AGGREGATES	3.38			10.39	4.96	0.82	0.18	0.27
095	0114	HALLMARK CARDS	2.08	0.00	0.06	4.35	0.19	0.19	0.01	9.51
095	0139	KANSAS CITY POWER AND LIGHT CO	11.89	0.00		24.50	0.97	0.97	0.35	0.30

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
095	0178	UNILEVER	6.98		0.23	8.31	5.13	0.63	0.05	0.46
095	0191	AERO TRANSPORTATION PRODUCTS INC								70.29
095	0222	INDEPENDENCE POWER AND LIGHT	0.10			1.88	0.13	0.00	0.11	0.04
095	0223	INDEPENDENCE POWER AND LIGHT	0.88			4.00	0.49	0.00	0.05	0.04
095	0224	INDEPENDENCE POWER AND LIGHT	0.06			1.12	0.08	0.00	0.07	0.02
095	0244	TIFFANY MARBLE INC	0.00		0.00	0.00	0.00	0.00	0.00	1.21
095	0267	COURTNEY RIDGE LANDFILL, LLC	45.08			2.40	9.20	1.84	0.84	5.12
095	0272	LEE'S SUMMIT SANITARY LANDFILL	20.48			1.09	3.13	0.73	0.38	3.50
095	0273	RUMBLE RECYCLING AND DISPOSAL SERVICES	52.68			2.85	1.20	1.20	1.00	0.12
095	0321	KANSAS CITY AGGREGATE LLC					0.03	0.03		
095	2001	CARGILL INC	0.00		0.00	0.00	13.57	12.04	0.00	177.71
095	2007	CROWN CENTER REDEVELOPMENT CORPORATION	7.57	0.00	0.27	9.30	0.69	0.69	0.12	0.52
095	2054	RESEARCH MEDICAL CENTER	2.38	0.00	0.33	9.54	0.22	0.13	0.06	0.21
095	2058	COOK BROTHERS INSULATION INC	0.00							0.01
095	2087	RESEARCH MEDICAL CENTER	0.66		0.01	2.64	0.14	0.14	0.01	0.05
095	2101	SOUTHEAST LANDFILL, LLC	59.19			3.16	1.34	1.34	1.10	2.04
095	2177	INTERNATIONAL PAPER COMPANY	2.38	0.00	0.01	2.84	0.81	0.22	0.02	0.35

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
095	2431	SUN CHEMICAL					0.02	0.01		0.41
097	0001	EMPIRE DISTRICT ELECTRIC CO	177.89	0.09	4.19	1,229.00	373.75	348.13	8,953.00	24.70
097	0007	DYNO NOBEL INC	1.94	0.00	2.12	7.92	3.91	0.37	0.44	1.32
097	0011	ADM MILLING COMPANY	0.10	0.00	0.00	0.12	1.90	0.68	0.00	0.01
097	0013	TAMKO BUILDING PRODUCTS INC	7.51	0.00	0.00	4.83	4.08	1.96	1.28	45.11
097	0021	ST. JOHN'S REGIONAL MEDICAL CENTER	2.02		0.00	2.41	0.18	0.18	0.01	0.13
097	0058	JUSTIN BOOT COMPANY					0.00	0.00		11.49
097	0062	EMPIRE DISTRICT ELECTRIC CO	5.40			35.00	2.99	2.98	0.00	2.88
097	0065	MODINE MANUFACTURING COMPANY	0.44			0.75	4.01	0.00	0.00	4.30
097	0089	ABLE MANUFACTURING & ASSEMBLY L.L.C.								62.39
097	0094	TAMKO BUILDING PRODUCTS INC	73.86	0.00		31.69	20.51	0.00	44.03	30.03
097	0095	ABLE MANUFACTURING CORPORATION								77.75
097	0104	EMPIRE DISTRICT ELECTRIC CO	575.86	0.00	62.02	107.60	46.35	46.35	4.30	55.97
097	0110	CARTHAGE WATER & ELECTRIC	6.28		0.42	70.67	4.42	0.76	1.72	3.56
097	0117	EAGLEPICHER TECHNOLOGIES LLC	0.21			1.00	0.05	0.00	0.01	7.94
097	0132	BEMIS PACKAGING LLC	2.48	0.00		2.95	0.22	0.22	0.02	177.59
097	0138	EBV EXPLOSIVES ENVIRONMENTAL CO	9.45	0.00	0.00	24.54	0.54	0.00	0.23	0.46
099	0002	RIVER CEMENT CO. DBA BUZZI UNICEM USA	1,168.99	0.04	5.85	1,756.58	322.25	168.46	280.98	136.58

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
099	0003	DOE RUN COMPANY	18.01	21.11	0.29	9.60	7.47	4.34	15,234.48	1.71
099	0011	UNION PACIFIC RAILROAD CO	1.10			1.55	3.05	2.68	0.01	26.36
099	0012	TRAUTMAN QUARRY					3.28	0.26		0.00
099	0014	DOW CHEMICAL COMPANY, THE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17
099	0016	AMEREN MISSOURI	1,242.97	0.00	1.40	3,441.72	686.65	246.31	28,035.60	149.10
099	0044	METAL CONTAINER CORPORATION	9.09			10.85	2.50	2.50	0.07	92.21
099	0052	ENGINEERED COIL COMPANY	0.00			0.00	0.00	0.00	0.00	5.73
099	0068	SAINT-GOBAIN CONTAINERS INC	9.24	0.20		107.22	90.86	87.03	149.07	26.36
099	0103	BUSSEN QUARRIES INC					11.42	0.22		0.00
099	0111	CARONDELET CORPORATION	4.18	0.00	0.07	6.46	16.53	0.14	0.24	27.23
099	0114	AERO METAL FINISHING				1.53	0.34	0.00	0.00	1.94
101	0002	UNIVERSITY OF CENTRAL MISSOURI	4.39			5.22	0.40	0.00	0.03	0.99
101	0009	WHITEMAN AIR FORCE BASE	19.35		0.08	26.99	2.51	0.32	1.62	12.04
101	0023	ENERSYS ENERGY PRODUCTS INC	3.50	0.02		4.21	0.94	0.08	0.33	33.50
101	0046	SHOW-ME REGIONAL LANDFILL	52.61	0.00		2.81	4.23	1.50	0.98	1.81
101	0051	HOLDEN POWER PLANT	0.64	0.00		6.78	0.84	0.84	0.54	0.59
101	0054	MASTER MARBLE INC	0.00			0.00	0.00	0.00		2.41
105	0001	INDEPENDENT STAVE CO INC	57.82	0.00	2.01	47.37	15.57	8.74	2.39	1.99

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
105	0006	BRUNSWICK FRESHWATER GROUP	0.67			0.81	0.32	0.00	0.00	48.80
105	0013	DETROIT TOOL AND ENGINEERING				0.00	0.08	0.00		0.70
105	0033	RBC MANUFACTURING CORPORATION	0.27	0.00	0.00	0.32	0.22	0.02	0.00	8.02
105	0038	G3 BOATS					0.00	0.00	0.00	25.95
105	0046	TRACKER MARINE	0.00			0.00	4.13	0.00	0.00	87.85
107	0004	REMINGTON ARMS	1.80	0.00		0.20	1.12	0.41	0.01	17.04
107	0010	WINCUP	5.16	0.00	0.03	6.15	0.47	0.00	0.04	51.08
107	0038	HIGGINSVILLE MUNICIPAL POWER FACILITY	0.48		0.04	1.73	0.04	0.04	0.04	0.08
107	0050	BARTLETT GRAIN COMPANY LP	0.00			0.00	2.21	0.56	0.00	0.00
109	0002	TRANSMONTAIGNE OPERATING COMPANY L.P.	0.59			0.24				9.97
109	0004	BCP INGREDIENTS	4.07			4.87	5.90	0.75	0.07	62.34
109	0008	MO REHABILITATION CENTER	0.26	0.00	0.01	1.22	0.03	0.03	0.08	0.10
109	0036	PHILLIPS 66 COMPANY	11.12			5.56	0.00	0.00		54.01
111	0019	AYERS OIL CO								16.27
111	0025	BFI BACKRIDGE LANDFILL	43.46			2.32	5.76	0.00	0.49	3.24
113	0003	OLD MONROE ELEVATOR & SUPPLY	0.01			0.02	0.98	0.20	0.00	0.00
113	0029	BODINE ALUMINUM INC	3.27			29.53	18.27	0.00	0.04	66.12
113	0042	FARMERS ELEVATOR & SUPPLY CO	0.00			0.01	0.97	0.14	0.00	0.00

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
115	0001	WALSWORTH PUBLISHING COMPANY	0.08		0.03	0.38	0.03	0.03	0.00	68.56
115	0021	MARCELINE MUNICIPAL UTILITY	0.04	0.00	0.00	0.17	0.00	0.00	0.06	0.01
117	0002	CHILLICOTHE MUNICIPAL UTILITIES	0.48	0.00		3.85	0.06	0.06	0.03	0.05
117	0012	DONALDSON CO INC	0.05	0.00	0.00	0.06	1.46	0.00	0.00	12.09
119	0017	SIMMONS FOODS INC	54.05		10.30	40.07	8.11	6.54	0.39	3.54
119	0030	WAL-MART NORTH DATA CENTER	0.41			13.30	0.09	0.00	0.23	0.27
121	0004	MACON MUNICIPAL UTILITIES	0.37			1.73	0.04	0.04	0.11	0.14
121	0027	VEOLIA ES MAPLE HILL LANDFILL, INC	44.93			2.40	3.37	1.25	0.84	1.55
121	0028	POET BIOREFINING	46.61			36.32	26.12	0.02	0.13	18.58
121	0033	MACON MUNICIPAL UTILITIES	12.06			17.69	3.26	3.26	0.29	1.04
121	0035	MACON MUNICIPAL UTILITIES	0.19			0.89	0.02	0.02	0.06	0.07
121	0036	MACON MUNICIPAL UTILITIES	0.12			0.57	0.01	0.01	0.04	0.05
123	0018	CENTERPOINT ENERGY	153.64			249.85	0.59	0.59	0.03	19.99
123	0022	VERSA-TECH INC	0.00		0.00	0.00	0.00	0.00	0.00	79.29
125	0001	KINGSFORD MANUFACTURING CO	44.57	0.02		169.64	101.73	98.71	18.43	89.43
127	0001	BASF CORPORATION	114.45	0.17	0.35	380.41	159.96	141.09	2,092.31	32.72
127	0002	MAGELLAN PIPELINE COMPANY LLC	4.28			1.71				11.42
133	0014	GATES CORPORATION	0.88			1.05	0.08	0.00	0.01	0.21

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
133	0016	CONSOLIDATED GRAIN AND BARGE CO	0.00			0.00	1.79	0.11		0.00
137	0028	MONROE CITY POWER PLANT	0.27			1.23	0.08	0.00	0.08	0.09
139	0008	CHRISTY MINERALS, LLC	71.70	0.00	0.00	147.67	15.33	0.04	549.52	0.00
143	0004	NEW MADRID POWER PLANT	6,311.54	0.00	19.45	8,637.73	400.31	292.54	14,957.09	233.07
143	0008	NORANDA ALUMINUM INC	24,562.97		0.96	30.53	488.33	220.86	5,876.44	243.95
143	0012	MAHAN GIN CO	0.04			0.31	6.03	0.00	0.00	0.01
143	0013	PORTAGEVILLE FARMERS GIN INC					6.73	0.16		
143	0015	SIEGEL-ROBERT AUTOMOTIVE	0.70		0.08	7.74	0.17	0.06	0.03	33.49
143	0023	MCCORD GIN - NORTH	0.00			0.00	15.68	0.46	0.00	0.00
143	0027	CARGILL INC - NEW MADRID ELEVATOR					1.10	0.19		
143	0046	A. C. RILEY COTTON COMPANY	0.00			0.00	6.44	0.00	0.00	0.00
143	0062	BUNGE NORTH AMERICA INC	0.04		0.01	0.15	6.91	1.10	0.32	0.00
145	0005	LA-Z-BOY, INCORPORATED	0.68		0.02	0.84	1.76	1.76	0.01	17.75
145	0007	FAG BEARINGS CORPORATION	5.79		0.01	0.18	0.01	0.01	0.00	31.54
145	0044	PREMIER TURBINES	11.49			13.44	0.85	0.10	2.37	15.29
145	0049	SAGINAW SOUTHERN STAR CENTRAL	4.78			34.27	0.65	0.53	0.00	17.85
147	0005	NORTHWEST MISSOURI STATE UNIVERSITY	54.52	0.00	0.00	23.16	2.84	2.07	1.62	1.56
147	0008	ENERGIZER BATTERY MANUFACTURING INC	1.87		0.07	2.23	0.29	0.17	0.01	20.84

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
147	0023	KAWASAKI MOTORS MFG CORP	111.83	0.00		8.15	22.80	11.74	0.28	147.04
147	0024	ANR PIPELINE COMPANY - TRANSCANADA CORP	223.21			931.71	18.03	18.03	0.22	37.66
147	0027	CONSUMERS OIL CO INC					0.53	0.00		0.69
147	0032	NODAWAY POWER PLANT	0.54			1.93	0.19	0.19	0.04	0.08
151	0002	CENTRAL ELECTRIC POWER COOPERATIVE	71.73	0.01	0.09	2,205.78	164.87	151.39	3,214.71	14.98
151	0050	QUAKER WINDOW PRODUCTS COMPANY	0.00			0.00	0.48	0.00	0.00	12.81
155	0024	STILL GIN AND GRAIN INC	0.00			0.00	3.21	0.14	0.00	0.00
155	0030	TRINITY MARINE PRODUCTS INC	0.35			1.76	12.43	0.05	0.01	48.05
155	0045	M-D PRODUCTS INC	2.33	0.00		2.77	0.33	0.21	0.02	10.60
155	0049	TRINITY MARINE PRODUCTS INC	0.08			0.41	0.02	0.00	0.00	53.85
155	0063	BUNGE NORTH AMERICA INC	0.00		0.00	0.00	1.71	0.17	0.00	0.00
157	0019	TG MISSOURI	0.80		0.01	4.92	3.94	0.24	0.04	109.71
157	0020	ATLAS EPS	2.32			2.58	5.76	0.00	22.89	83.69
157	0027	TNT PLASTICS INC	0.00			0.00	0.00	0.00	0.00	52.02
159	0009	PITTSBURGH-CORNING CORP	24.57			199.77	40.30	3.03	150.74	5.94
159	0012	WATERLOO INDUSTRIES INC	5.31			6.32	0.49	0.00	0.04	31.19
159	0022	ALCAN CABLE	2.73	0.00	0.10	3.25	0.25	0.25	0.02	13.77
159	0027	HAYES LEMMERZ INTERNATIONAL INC	3.82	0.00		4.55	0.50	0.00	0.03	66.77

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
159	0037	TYSON FOODS INC	31.04		9.04	36.96	19.06	1.84	0.22	2.73
159	0041	MISSOURI PRESSED METALS INC	0.05		0.01	0.35	0.15	0.00	0.00	10.90
159	0047	PANHANDLE EASTERN PIPE LINE CO	362.30			1,844.10	38.17	38.17	0.47	94.93
159	0055	CENTRAL MISSOURI SANITARY LANDFILL	2.40				13.54	1.35		10.84
159	0056	EDWARDS FIBERGLASS INC								28.11
161	0006	MISSOURI UNIV. OF SCIENCE AND TECHNOLOGY	48.99	0.00	5.27	51.20	11.13	4.62	452.21	1.05
161	0039	MANCHESTER PACKAGING COMPANY	0.01			0.04	0.00	0.00	0.00	46.78
161	0054	ROLLA MUNICIPAL UTILITIES	0.05			1.97	0.06	0.06	0.04	0.08
163	0002	ASHLAND INC	19.93	0.01	2.67	295.33	43.86	7.69	1,835.57	58.76
163	0008	WAYNE B SMITH INC	0.00			0.02	9.37	0.63	0.00	0.06
163	0025	BUNGE NORTH AMERICA INC	0.02		0.00	0.02	3.72	0.56	0.00	0.00
163	0031	DYNO NOBEL INC	1.51		20.56	462.41	110.41	53.00	0.02	0.16
163	0040	EAGLE RIDGE LANDFILL	1.12				3.55	0.36		3.63
163	0047	AMEREN MISSOURI	3.05			49.65	5.64	0.00	0.34	5.08
165	0007	KANSAS CITY POWER AND LIGHT CO	1,126.77	0.11	2.13	2,480.04	504.89	407.79	290.60	9.26
165	0021	MULTI-COLOR CORPORATION	0.00		0.00	0.00	0.00	0.00	0.00	10.94
165	0028	WOODBRIDGE CORPORATION	1.39		0.01	1.65	0.13	0.13	0.01	89.80
165	2404	KCI AIRPORT - KCMO AVIATION DEPT	2.81	0.00	0.03	5.43	0.40	0.40	0.20	2.72

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
165	2415	HARLEY DAVIDSON MOTOR COMPANY	4.09		0.83	6.05	0.47	0.47	0.04	19.51
165	2424	FACILITY OPERATION SERVICES LLC	5.50		0.00	18.34	0.50	0.50	0.04	0.36
169	0004	INSTALN MGMNT CMND AND FT LEONARD WOOD	15.31	0.00	9.37	46.23	3.41	0.53	3.28	8.87
171	0015	UNIONVILLE POWER PLANT	0.01	0.00	0.05	2.20	0.03	0.03	0.11	0.20
173	0001	CONTINENTAL CEMENT COMPANY LLC	467.94	0.00		788.33	81.75	0.28	101.18	82.50
173	0021	ENNIS PAINT INC					0.47	0.00		4.69
173	0037	BUCKHORN RUBBER PRODUCTS INC	0.00	0.04	0.00	0.00	11.44	11.36	0.00	6.98
175	0001	THOMAS HILL ENERGY CENTER POWER DIVISION	5,444.35	0.00	72.50	8,484.24	544.00	469.97	19,246.07	194.64
175	0010	AMEREN MISSOURI	0.05	0.00		0.71	0.04	0.00	1.03	0.02
175	0061	WILSON TRAILER SALES INC	0.00		0.00	0.00	0.24	0.24	0.00	9.75
179	0006	DOE RUN COMPANY	0.00	0.73		0.00	20.43	3.08	0.00	2.43
183	0001	AMEREN MISSOURI	710.19	0.00	0.80	7,073.99	445.74	413.52	4,899.10	156.50
183	0004	FRED WEBER INC	21.92		0.00	1.37	1.40	0.05	0.25	0.45
183	0010	BOEING COMPANY	1.70	0.00	0.06	2.03	0.36	0.15	0.01	5.66
183	0019	ST. JOSEPH HEALTH CENTER	3.36		0.02	4.85	2.95	0.36	0.10	0.30
183	0027	MEMC ELECTRONIC MATERIALS INC	9.49		2.62	11.83	7.82	4.41	0.09	6.51
183	0076	GENERAL MOTORS LLC	100.28	0.27	0.31	270.49	35.91	26.16	424.24	480.05
183	0077	O'FALLON CASTING LLC	1.55		0.96	1.85	0.14	0.14	0.01	26.09
183	0129	WOODBRIDGE CORPORATION	0.00		0.00	0.00	0.01	0.00		89.65

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
183	0131	SUPERIOR HOME PRODUCTS INC	0.00			0.01	0.14	0.00	0.00	7.15
183	0184	TRUE MANUFACTURING CO	1.14	0.00		3.43	0.29	0.29	0.02	26.76
183	6003	LAMI WOOD PRODUCTS					0.00	0.00		2.94
186	0001	MISSISSIPPI LIME COMPANY	12,394.15		0.01	3,630.41	1,251.25	576.74	3,536.36	53.80
186	0022	TOWER ROCK STONE CO					14.39	0.04		0.00
186	0024	CENTERPOINT ENERGY	5.62		0.00	49.16	0.36	0.36	0.01	6.49
186	0035	LHOIST NORTH AMERICA OF MISSOURI	25.74	0.01		1,262.89	125.10	36.65	9.98	7.78
186	0044	HOLCIM (US) INC	943.31	0.01	54.27	1,975.58	429.35	194.89	170.63	279.89
187	0001	LEAD BELT MATERIALS CO INC	15.55	0.00	0.00	4.81	8.19	0.39	0.28	0.62
187	0002	VALLEY MINERALS, LLC	28.02			57.91	47.01	10.03	3.83	0.00
187	0006	IRON MOUNTAIN TRAP ROCK CO					17.17	0.00		
187	0017	PIRAMAL GLASS USA INC	4.65		3.31	363.24	93.08	45.72	19.01	6.26
187	0048	SIEGEL-ROBERT AUTOMOTIVE	0.25		7.73	4.10	0.10	0.00	0.02	20.88
187	0054	LEAD BELT MATERIALS CO INC	6.59	0.00	0.00	5.47	3.88	0.36	2.85	1.71
187	0072	BASE ROCK MINERALS INC	0.99	0.00		2.98	12.54	2.21	2.19	0.89
187	0075	FARMINGTON LIGHT & POWER	0.51		0.01	1.20	0.04	0.03	0.00	0.19
189	0010	AMEREN MISSOURI	3,843.21		1.13	4,789.24	458.51	171.92	15,281.50	105.64
189	0017	FRED WEBER, INC - NORTH STONE					25.91	1.84		
189	0020	MONSANTO WORLD	13.41	0.00	0.50	22.23	1.23	0.34	0.47	0.94

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
		HEADQUARTERS								
189	0023	AMEREN MISSOURI	0.07	0.00		1.00	0.05	0.00	1.45	0.02
189	0032	MONSANTO	15.41		0.44	18.89	1.20	1.20	0.27	1.02
189	0035	ROCKWOOD PIGMENTS NA INC	7.89	0.00	0.35	11.26	3.34	0.23	5.82	0.68
189	0042	WASHINGTON UNIVERSITY	16.59	0.00	0.10	20.43	14.34	1.54	0.20	1.13
189	0057	ST. LOUIS POST-DISPATCH	0.23		0.00	0.27	0.02	0.01	0.00	12.54
189	0064	SUNNEN PRODUCTS COMPANY	1.09		0.04	1.30	0.10	0.02	0.01	5.57
189	0065	ST. LOUIS AIRPORT AUTHORITY	8.46	0.00	0.31	13.22	12.00	0.29	0.06	4.17
189	0069	THE QUIKRETE COMPANIES, INC.	0.99	0.00	0.04	1.18	10.66	0.00	0.01	0.06
189	0111	MISSOURI ASPHALT PRODUCTS, LLC	10.29	0.00		3.09	1.99	0.06	2.26	0.21
189	0141	ENERGY PETROLEUM COMPANY								7.36
189	0208	PRINTPACK INC	3.48		0.13	4.15	0.32	0.08	0.02	71.05
189	0217	METROPOLITAN ST. LOUIS SEWER DISTRICT	275.24	0.02	467.90	44.39	3.76	1.60	1.78	16.11
189	0226	GREIF-FENTON	1.45		0.00	1.72	0.13	0.00	0.01	39.65
189	0230	THE BOEING COMPANY	20.00	0.00	0.70	24.08	4.55	2.15	0.47	48.43
189	0238	ST. LOUIS LITHOGRAPHING COMPANY								18.82
189	0275	BUSSEN QUARRIES INC					9.27	0.38		
189	0276	RUPRECHT QUARRY					0.05	0.00		
189	0281	BFI MISSOURI PASS	65.11			3.47	1.48	1.48	1.22	2.24

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
		LANDFILL								
189	0282	CENVEO ST. LOUIS	0.15		0.01	0.18	0.01	0.00	0.00	2.95
189	0308	IESI MO CHAMP LANDFILL	199.09			10.62	9.84	4.94	3.72	9.67
189	0310	ADVANCED DISPOSAL SERVICES	121.20			6.46	3.57	2.83	2.26	4.33
189	0312	BRIDGETON LANDFILL, LLC	216.66			11.56	4.91	4.91	4.04	7.47
189	0315	FOL TAPE LLC	0.00			0.00	0.00	0.00	0.00	29.83
189	0317	PRO-TECT MFG INC								17.70
189	0318	ST. MARYS HEALTH CENTER	5.34		0.03	6.44	0.48	0.12	0.04	0.39
189	0327	CAMIE-CAMPBELL INC								4.06
189	1012	BELT SERVICE CORP	0.00		0.00	0.00	0.97	0.00	0.00	34.67
189	1029	SSM DEPAUL HEALTH CENTER	5.48	0.00	0.03	5.54	0.52	0.51	0.49	0.36
189	1097	REICHHOLD, INC	3.85		0.15	4.58	1.14	0.17	0.06	30.71
189	1101	ST. LUKE'S HOSPITAL	5.32		0.04	6.43	0.13	0.13	0.51	0.35
189	1205	MSD, MISSOURI RIVER WWTP	7.83		103.16	89.31	0.27	0.27	3.66	11.12
189	1210	MSD, COLDWATER CREEK WWTP	0.00		90.61	0.00	0.00	0.00	0.00	0.17
189	1226	SIMPSON CONSTRUCTION MATERIALS LLC	19.17	0.00		5.68	22.85	0.70	4.17	1.82
189	1248	FRED WEBER INC. - SOUTH ASPHALT (BATCH)	20.56			1.40	1.59	0.01	0.24	0.42
189	1249	FRED WEBER INC - NORTH ASPHALT H AND B	33.57			4.64	2.01	0.00	0.82	1.48
189	1250	FRED WEBER INC. - NORTH ASPHALT B-G	15.01			1.18	0.64	0.00	0.17	0.00

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
189	1489	GKN AEROSPACE NORTH AMERICA, INC.	15.46		0.59	8.10	14.23	12.26	0.20	58.61
189	1516	J.D. STREETT AND COMPANY INC								15.44
189	1520	F AND S PRINTING								48.52
195	0004	CONAGRA FOODS	5.22	0.00	0.20	7.29	6.32	0.47	0.04	1.25
195	0010	MARSHALL MUNICIPAL UTILITIES	13.02	0.01	0.06	151.36	38.47	36.76	771.74	1.44
195	0046	MID-MISSOURI ENERGY LLC	62.43			58.98	43.55	10.09	0.43	33.13
201	0003	TETRA PAK MATERIALS	0.25		0.00	0.30	0.02	0.02	0.00	31.67
201	0017	SIKESTON POWER STATION	3,253.34	0.01		2,181.60	566.45	467.53	6,047.80	16.77
201	0018	ENTERPRISE REFINED PRODUCTS COMPANY LLC								36.58
201	0021	HAVCO WOOD PRODUCTS INC	72.63	0.00	0.00	26.63	34.73	7.02	3.03	2.02
201	0073	CROWDER GIN COMPANY INC	0.03			0.22	8.32	0.24	0.00	0.01
201	0099	TEXAS EASTERN TRANSMISSION LP	17.14			391.43	1.84	1.84	0.06	7.96
201	0102	MANAC TRAILERS USA INC	0.00			0.00	1.18	0.00	0.00	14.52
201	0110	CONSTRUCTION TRAILER SPECIALISTS INC					0.00	0.00		14.40
201	8001	CONSOLIDATED GRAIN AND BARGE CO	0.32			1.50	1.59	0.12	0.01	0.08
203	0005	HARDWOODS OF MISSOURI LLC	7.79	0.00		6.36	1.84	0.23	0.32	0.22
205	0010	CERRO FLOW PRODUCTS LLC	97.15			4.29	0.21	0.00	0.03	20.36
205	0011	SHELBINA POWER PLANT	0.65			3.76	0.10	0.10	0.05	0.14

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
207	0007	AMES TRUE TEMPER INC	11.89			1.31	6.90	3.45	0.06	1.22
207	0008	J. P. ROSS COTTON CO INC	0.07			0.50	23.80	0.45	0.00	0.02
207	0014	NESTLE PURINA PETCARE COMPANY	38.26	0.00		59.20	25.64	13.73	0.27	2.51
207	0018	STODDARD COUNTY COTTON CO	0.21			0.24	24.45	0.72	0.00	0.01
207	0019	W. W. WOOD PRODUCTS	0.39	0.00		2.28	8.86	0.07	0.01	197.20
207	0062	LEMONS SANITARY LANDFILL	75.23	0.00		4.01	14.91	3.03	1.40	2.59
207	0064	ESSEX POWER PLANT	0.06			2.87	0.60	0.60	0.04	0.10
209	0007	TABLE ROCK ASPHALT CONSTR CO INC					5.99	0.00		
213	0003	TABLE ROCK ASPHALT CONSTR CO INC	0.57			1.03	5.36	0.00	2.57	0.34
213	0007	ROYAL OAK ENTERPRISES	20.48	0.00		7.51	19.64	6.98	0.85	4.80
213	0048	COLLEGE OF THE OZARKS	4.35	0.00	0.12	5.54	1.90	0.04	0.48	1.53
215	0026	DAIRY FARMERS OF AMERICA INC	6.55	0.00	0.00	7.79	0.60	0.59	0.05	1.08
215	0060	WOODPRO CABINETRY INC	1.55			0.17	0.32	0.00	0.04	21.69
217	0004	3M COMPANY	23.43			27.91	2.12	0.00	0.17	250.93
217	0034	KANSAS CITY POWER AND LIGHT CO	0.00	0.00		0.66	0.01	0.01	0.01	0.00
217	0043	ADM	8.59	0.00		8.55	13.09	7.49	0.06	31.96
219	0013	SAF-HOLLAND USA	0.00				1.15	0.00		31.22
219	0036	GREIF PACKAGING LLC	0.09		0.00	0.11	0.01	0.00	0.00	11.61
219	0038	CASCADES PLASTICS INC					0.00	0.00		163.26

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
221	0008	RED WING SHOE COMPANY INC								23.02
221	0018	BUCKMAN LABORATORIES INC	2.05		0.08	2.44	0.19	0.19	0.01	0.13
221	0022	PURCELL TIRE & RUBBER COMPANY	1.18			1.40	1.06	0.44	0.01	12.32
221	0031	IESI CORPORATION	11.19			0.60	2.01	0.25		4.51
225	0026	HUTCHENS INDUSTRIES	0.16		0.04	0.48	0.59	0.01	0.00	1.18
225	0040	OZARK HARDWOOD PRODUCTS LLC	18.06			1.99	6.15	0.00		
225	0045	UNDERCOVER INC	0.38			0.45	0.03	0.03	0.00	7.64
229	0001	HUTCHENS INDUSTRIES	0.51		0.10	1.32	2.39	0.04	0.01	21.28
229	0022	BLACK OAK RECYCLING & DISPOSAL FACILITY	4.30				13.03	1.30		4.62
510	0003	ANHEUSER-BUSCH INC	76.68		31.81	467.42	181.06	158.07	2,998.41	215.08
510	0017	MALLINCKRODT LLC	35.03	0.00	1.45	42.88	12.29	11.40	5.91	39.90
510	0027	PRECOAT METALS	8.06			9.60	0.73	0.00	0.06	54.63
510	0031	ADM GRAIN COMPANY	0.38			0.46	3.66	0.61	0.00	0.03
510	0038	TRIGEN-ST. LOUIS ENERGY CORP	36.17	0.00	1.73	54.87	4.73	4.73	1.16	2.67
510	0040	WASHINGTON UNIV MEDICAL SCHOOL	27.03	0.00	0.16	37.80	31.96	2.82	1.02	2.08
510	0047	FRED WEBER INC	5.29			0.52	0.05	0.00	0.06	0.11
510	0053	METROPOLITAN ST. LOUIS SEWER DISTRICT	558.38	0.18	476.95	80.58	23.77	3.45	15.47	40.20
510	0057	PROCTER AND GAMBLE	10.72		0.41	12.79	30.42	30.38	0.21	2.90
510	0063	THE DIAL CORPORATION	1.41	0.00	0.05	1.68	0.13	0.13	0.01	0.09

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
510	0066	ELEMENTIS SPECIALTIES INC	4.06		0.15	4.84	13.74	0.32	0.03	68.02
510	0070	ICL PERFORMANCE PRODUCTS LP	23.24		0.48	7.05	12.56	1.14	0.12	1.12
510	0096	ELANTAS PDG, INC.	3.96		0.15	5.39	0.40	0.40	0.03	6.96
510	0097	U S PAINT CORPORATION					3.07	0.00		24.47
510	0118	JW ALUMINUM	12.93	0.00	0.00	21.65	38.23	36.64	0.16	275.65
510	0161	POLY ONE CORPORATION					0.00	0.00		0.22
510	0162	MARQUETTE TOOL AND DIE								6.10
510	0175	ST. LOUIS METALLIZING COMPANY	0.08			0.29	0.33	0.00	0.00	3.14
510	0179	ITALGRANI ELEVATOR USA	0.31		0.01	0.37	28.42	0.78	0.00	0.64
510	0204	BARNES JEWISH HOSPITAL	2.67	0.00		11.66	0.61	0.00	1.14	0.60
510	0269	SENSIENT COLORS LLC	2.18		0.08	2.62	0.38	0.20	0.08	0.15
510	0391	HERMANN OAK LEATHER CO	0.00			0.00	0.00	0.00	0.00	8.95
510	0468	LANGE-STEGMANN COMPANY	1.64		0.06	1.95	11.69	0.04	0.01	0.11
510	0697	SIGMA - ALDRICH MFG LLC	8.85		0.17	9.95	0.76	0.35	0.06	10.75
510	0808	CHEMISPHERE CORPORATION								10.03
510	0809	PQ CORPORATION (THE)	9.47	0.00	0.51	92.55	32.96	32.56	0.07	4.29
510	0938	INTERSTATE BRANDS CORP	2.56		0.05	3.56	0.23	0.23	0.02	35.44
510	1055	GOODWIN PRINTING CO.								7.01
510	1077	MID-WEST INDUSTRIAL CHEMICAL	0.00	0.00		0.00	2.14	0.00	0.00	5.14

County Number	Plant Number	Plant Name	CO	Lead	NH_3	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_x	VOC
510	1093	BRENNTAG MID-SOUTH INC	0.00			0.00	0.00	0.00	0.00	3.95
510	1123	U. S. RINGBINDER LP					0.00	0.00		4.93
510	1280	ST. LOUIS POST DISPATCH	0.44		0.00	0.52	0.04	0.01	0.00	0.24
510	1370	NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY	1.31	0.00	0.04	1.63	0.15	0.13	0.02	0.09
510	1407	SOUTHERN METAL PROCESSING	1.68			4.19	0.26	0.26	6.22	0.89
510	1460	ALLIED HEALTH CARE PRODUCTS	0.00			0.00	0.00	0.00	0.00	2.75
510	1505	ENERGY CENTER (THE)	9.77	0.00	0.37	11.77	0.89	0.89	0.08	0.65
510	1556	CONNECTOR CASTINGS	0.00	0.00	0.01	0.11	4.65	0.53	0.01	0.86
510	1642	J S ALBERICI CONSTRUCTION	0.00			0.00	1.61	0.00	0.00	6.07
510	2300	SUPERIOR SOLVENT AND CHEMICAL								2.35
510	2378	HERTZ ST. LOUIS ONE, LLC	304.66	0.00	0.00	197.04	3.98	1.69	0.05	2.57
510	2433	NEW WORLD PASTA	3.30	0.00	0.13	3.93	0.80	0.80	0.02	0.22
510	2711	ST. LOUIS UNIVERSITY	6.02		0.04	7.17	0.54	0.54	0.04	0.39
Statewide Total			113,272	42	1,642	92,721	16,727	9,834	255,217	14,503

Table 3 Point Source Ozone Season Day Emissions (pounds per day)

County Number	Plant Number	Plant Name	CO	NO_x	VOC
071	0003	AMEREN MISSOURI	15,093.09	55,437.04	1,810.64
071	0014	CANAM STEEL CORP	0.00	12.01	361.18
071	0020	STEELWELD EQUIPMENT CO INC	0.84	1.00	42.02
071	0031	GRAPHIC PACKAGING INTERNATIONAL	0.00	0.00	206.04
071	0068	MERAMEC INDUSTRIES INC	0.21	1.00	410.79
071	0080	SPARTAN SHOWCASE INC	0.00	0.00	77.43
071	0087	BULL MOOSE TUBE COMPANY	1.65	2.86	200.43
071	0131	SULLIVAN PRECISION METAL FINISHING INC	0.00	0.00	27.38
071	0132	SPORLAN VALVE DIVSION			184.35
071	0151	AEROFIL TECHNOLOGY INC	0.20	1.00	240.82
071	0153	MAGNET LLC			61.31
071	0157	PLAZE INCORPORATED	2.52	12.00	496.22
071	0173	HENNIGES AUTOMOTIVE SEALING SYSTEMS NA		2.80	41.83
071	0230	PLAZE, INC	3.36	4.00	112.78
099	0002	RIVER CEMENT CO. DBA BUZZI UNICEM USA	6,422.65	9,649.45	968.79
099	0003	DOE RUN COMPANY	98.81	52.90	9.35
099	0011	UNION PACIFIC RAILROAD CO	9.60	12.82	243.36
099	0012	TRAUTMAN QUARRY			0.00
099	0014	DOW CHEMICAL COMPANY, THE	0.00	0.00	6.69
099	0016	AMEREN MISSOURI	7,348.02	20,366.24	881.15
099	0044	METAL CONTAINER CORPORATION	99.17	118.06	542.64
099	0052	ENGINEERED COIL COMPANY	0.00	0.00	36.73
099	0068	SAINT-GOBAIN CONTAINERS INC	50.17	588.43	145.12
099	0103	BUSSEN QUARRIES INC			0.00
099	0111	CARONDELET CORPORATION	14.93	28.50	200.12
099	0114	AERO METAL FINISHING		11.83	11.91

County Number	Plant Number	Plant Name	CO	NO_x	VOC
183	0001	AMEREN MISSOURI	4,858.89	48,695.56	1,070.67
183	0004	FRED WEBER INC	229.28	14.33	4.70
183	0010	BOEING COMPANY	4.20	5.00	44.40
183	0019	ST. JOSEPH HEALTH CENTER	20.48	60.32	4.58
183	0027	MEMC ELECTRONIC MATERIALS INC	51.34	64.28	28.05
183	0076	GENERAL MOTORS LLC	439.66	1,153.77	4,216.30
183	0077	O'FALLON CASTING LLC	6.72	8.00	132.00
183	0129	WOODBRIDGE CORPORATION	0.00	0.00	692.21
183	0131	SUPERIOR HOME PRODUCTS INC	0.00	0.00	55.78
183	0184	TRUE MANUFACTURING CO	4.20	5.00	204.65
183	6003	LAMI WOOD PRODUCTS			30.28
189	0010	AMEREN MISSOURI	24,250.76	29,073.78	644.43
189	0020	MONSANTO WORLD HEADQUARTERS	33.74	72.70	2.52
189	0023	AMEREN MISSOURI	1.51	21.99	0.53
189	0032	MONSANTO	131.95	459.02	12.56
189	0035	ROCKWOOD PIGMENTS NA INC	42.21	60.00	3.62
189	0042	WASHINGTON UNIVERSITY	270.19	959.88	69.88
189	0057	ST. LOUIS POST-DISPATCH	1.68	2.00	70.12
189	0064	SUNNEN PRODUCTS COMPANY	3.36	4.00	45.19
189	0065	ST. LOUIS AIRPORT AUTHORITY	34.83	99.43	88.54
189	0069	THE QUIKRETE COMPANIES, INC.	8.40	10.00	0.55
189	0111	MISSOURI ASPHALT PRODUCTS, LLC	152.70	45.81	3.13
189	0141	ENERGY PETROLEUM COMPANY			43.10
189	0208	PRINTPACK INC	21.84	26.00	572.25
189	0217	METROPOLITAN ST. LOUIS SEWER DISTRICT	1,693.84	273.20	99.55
189	0226	GREIF-FENTON	12.60	15.00	341.57
189	0230	THE BOEING COMPANY	74.72	155.56	274.17

County Number	Plant Number	Plant Name	CO	NO_x	VOC
189	0238	ST. LOUIS LITHOGRAPHING COMPANY			139.01
189	0281	BFI MISSOURI PASS LANDFILL	360.00	19.20	12.45
189	0282	CENVEO ST. LOUIS	0.00	0.00	0.00
189	0308	IESI MO CHAMP LANDFILL	1,095.00	58.40	52.49
189	0310	ADVANCED DISPOSAL SERVICES	667.50	35.60	23.50
189	0312	BRIDGETON LANDFILL, LLC	1,192.50	63.60	40.26
189	0315	FOL TAPE LLC	0.00	0.00	197.24
189	0317	PRO-TECT MFG INC			180.00
189	0318	ST. MARYS HEALTH CENTER	21.84	26.00	1.43
189	0327	CAMIE-CAMPBELL INC			27.40
189	1012	BELT SERVICE CORP	0.00	0.00	320.10
189	1029	SSM DEPAUL HEALTH CENTER	36.96	36.70	2.42
189	1097	REICHHOLD, INC	21.00	25.00	180.01
189	1101	ST. LUKE'S HOSPITAL	29.40	35.00	1.92
189	1205	MSD, MISSOURI RIVER WWTP	45.17	487.11	61.58
189	1210	MSD, COLDWATER CREEK WWTP	0.00	0.00	0.88
189	1226	SIMPSON CONSTRUCTION MATERIALS LLC	278.91	82.69	26.41
189	1248	FRED WEBER INC. - SOUTH ASPHALT (BATCH)	316.13	21.10	6.48
189	1249	FRED WEBER INC - NORTH ASPHALT H AND B	474.69	65.20	20.96
189	1250	FRED WEBER INC. - NORTH ASPHALT B-G	166.24	13.19	0.05
189	1489	GKN AEROSPACE NORTH AMERICA, INC.	40.32	23.25	366.71
189	1516	J.D. STREETT AND COMPANY INC			84.67
189	1520	F AND S PRINTING			381.50
510	0003	ANHEUSER-BUSCH INC	468.57	2,857.63	1,313.26
510	0017	MALLINCKRODT LLC	239.92	443.05	364.28
510	0027	PRECOAT METALS	63.00	75.00	395.69

County Number	Plant Number	Plant Name	CO	NO_x	VOC
510	0031	ADM GRAIN COMPANY	2.52	3.00	0.16
510	0038	TRIGEN-ST. LOUIS ENERGY CORP	136.92	181.60	10.01
510	0040	WASHINGTON UNIV MEDICAL SCHOOL	53.63	234.42	16.35
510	0047	FRED WEBER INC	51.93	4.62	1.07
510	0053	METROPOLITAN ST. LOUIS SEWER DISTRICT	10,833.63	1,849.17	526.63
510	0057	PROCTER AND GAMBLE	184.01	219.20	24.35
510	0063	THE DIAL CORPORATION	6.72	8.00	0.44
510	0066	ELEMENTIS SPECIALTIES INC	22.68	27.00	402.73
510	0070	ICL PERFORMANCE PRODUCTS LP	131.32	48.28	6.63
510	0096	ELANTAS PDG, INC.	21.32	28.22	41.18
510	0097	U S PAINT CORPORATION			169.05
510	0118	JW ALUMINUM	71.65	120.00	1,546.71
510	0161	POLY ONE CORPORATION			2.12
510	0162	MARQUETTE TOOL AND DIE			40.00
510	0175	ST. LOUIS METALLIZING COMPANY	0.00	0.00	20.00
510	0179	ITALGRANI ELEVATOR USA	2.52	3.00	0.16
510	0204	BARNES JEWISH HOSPITAL	43.54	196.73	12.30
510	0269	SENSIENT COLORS LLC	8.40	10.14	0.58
510	0391	HERMANN OAK LEATHER CO	0.00	0.00	57.26
510	0468	LANGE-STEGMANN COMPANY	9.24	11.00	0.62
510	0697	SIGMA - ALDRICH MFG LLC	45.36	49.50	52.73
510	0808	CHEMISPHERE CORPORATION			75.16
510	0809	PQ CORPORATION (THE)	52.65	509.24	23.60
510	0938	INTERSTATE BRANDS CORP	15.96	22.60	381.82
510	1055	GOODWIN PRINTING CO.			65.64
510	1077	MID-WEST INDUSTRIAL CHEMICAL	0.00	0.00	39.60
510	1093	BRENNTAG MID-SOUTH INC	0.00	0.00	30.41

County Number	Plant Number	Plant Name	CO	NO_x	VOC
510	1123	U. S. RINGBINDER LP			38.17
510	1280	ST. LOUIS POST DISPATCH	0.84	1.00	0.05
510	1370	NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY	4.66	10.04	0.71
510	1407	SOUTHERN METAL PROCESSING	12.19	30.49	6.47
510	1460	ALLIED HEALTH CARE PRODUCTS	0.00	0.00	19.70
510	1505	ENERGY CENTER (THE)	26.51	36.08	2.13
510	1556	CONNECTOR CASTINGS	0.00	0.99	6.54
510	1642	J S ALBERICI CONSTRUCTION	0.00	0.00	54.38
510	2300	SUPERIOR SOLVENT AND CHEMICAL			18.03
510	2378	HERTZ ST. LOUIS ONE, LLC	1,970.52	1,277.58	16.94
510	2433	NEW WORLD PASTA	18.48	22.00	1.21
510	2711	ST. LOUIS UNIVERSITY	32.76	39.00	2.14
Areawide Total			80,771.43	176,897.19	23,988.89

8.0 Nonpoint Source Inventory

Nonpoint emissions estimates were developed by EPA for the 2011 inventory. Where appropriate, Missouri accepted these estimates with no modifications and has provided the documentation generated by EPA.

When it was determined that emissions from Missouri may be substantially different than EPA estimates, state specific information was used to produce more accurate data. For some source categories, this was done by modifying the numbers produced by EPA. In other instances, estimates were developed by DNR.

Additional nonpoint emissions estimates were developed by contractors hired by CenSARA (Central States Air Resources Agencies). The following source categories used emissions estimates developed by CenSARA contractors: Agricultural Pesticide, Industrial, Commercial, Institutional, and Residential Fuel Combustion, and Oil and Gas Drilling.

The different documentation sources vary in style and organization. Each subsection was left in its original formatting.

This 2011 inventory does not include biogenic or geogenic emissions. The inventory does not include the nonpoint categories for wildfire which are in the event inventory.

8.1 Agricultural Pesticide

CenSARA hired a contractor to develop Agricultural Pesticide emissions for the region. Documentation of the methods used can be found in Appendix B-2.

8.2 *Agricultural Tilling*

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection g contains Missouri's audit of EPA's estimate.

a. Source Category Description

Fugitive dust emissions from agricultural tilling include the airborne soil particulate emissions produced during the preparation of agricultural lands for planting. Fugitive dust emissions from agricultural tilling were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2801000003	Miscellaneous Area Sources	Agriculture Production - Crops	Agriculture - Crops	Tilling

Particulate emissions from agricultural tilling were computed by multiplying a crop specific emissions factor by an activity factor, as discussed below.

b. Emission Factor Equation

The county-level emissions factors for agricultural tilling (in lbs per acre) are specific to the crop and tilling type and were calculated using the following equation:[1,2]

$$EF = 4.8 \times k \times s^{0.6} \times p_{crop,tilling\ type}$$

where:

k = dimensionless particle size multiplier (PM_{10} = 0.21; $PM_{2.5}$ = 0.042),

s = silt content of surface soil (%),

p = number of passes or tillings in a year for a given crop and tillage type.

The silt content of surface soil is defined as the percentage of particles (mass basis) of diameter smaller than 75 micrometers (µm) found in the soil to a depth of 10 centimeters (cm). Silt contents were assigned by comparing the United States Department of Agriculture (USDA) surface soil survey map to a USDA county map and assigning a soil type to each county. The table below shows silt content assumed for each soil type.

Silt Content for Soil Types in USDA Surface Soil Map

Soil Type	Silt Content (%)
Silt Loam	52
Sandy Loam	33
Sand	12
Loamy Sand	12
Clay	29
Clay Loam	29
Organic Material	10-82
Loam	40

The table below shows the number of passes or tillings in a year for each crop for conservation use and conventional use.[3] No till, mulch till, and ridge till tillage systems are classified as conservation use, while 0 to 15 percent residue and 15 to 30 percent residue tillage systems are classified as conventional use.

Number of Passes or Tillings per Year.

Crop	Conservation Use	Conventional Use
Barley	3	5
Beans and Peas	3	3
Canola	3	3
Corn	2	6
Cotton	5	8
Cover	1	1
Fallow	1	1
Fall-seeded Wheat	3	5
Forage	3	3
Hay	3	3
Oats	3	5
Peanuts	3	3
Permanent Pasture	1	1
Potatoes	3	3
Rice	5	5
Rye	3	5
Sorghum	1	6
Soybeans	1	6
Spring Wheat	1	4
Sugarbeets	3	3
Sugarcane	3	3
Sunflowers	3	3
Tobacco	3	3

c. Activity

The basis of agricultural tilling emission estimates was the number of acres of crops tilled in each county by crop type and tillage type. These data were obtained from the *2008 National Crop Residue Management Survey*, developed by the Conservation Technology Information Center (CTIC).[4] Data summaries are available on the CTIC web site at: http://www.ctic.purdue.edu/CRM/. The five types of tilling for which emission estimates were calculated are:

Conservation Till	Conventional Till
No till/strip till	0 to 15 percent residue till (Intensive Till)
Mulch till	15 to 30 percent residue till (Reduced till)
Ridge till	

Note that the 2008 activity data for highly erodible land (HEL) overlap the other crop-type-specific data. Therefore, the HEL and Treated HEL data are not included in the calculation of emissions estimates. A summary of national-level acres planted in 2008 for each tilling type are presented in the table below. Due to data nondisclosure agreements with CTIC, the EPA cannot release the county-level tillage data by crop type.

Acres Planted by Tillage Type, Fallow and Pasture in 2008

Tillage System	**Actual National Number of Acres Planted in 2008 (million acres)**
Conservation	
No-Till/Strip Till	74.86
Ridge-Till	2.32
Mulch-Till	49.43
Conventional	
Reduced-Till (15-30% cover)	63.31
Intensive-Till (<15% cover)	105.13
Total	295.05

The following equation was used to determine the emissions from agricultural tilling for 2008.[1,2] The county-level activity data are the acres of land tilled for a given crop and tilling type. The equation is adjusted to estimate PM_{10} and $PM_{2.5}$ emissions using the following parameters: a particle size multiplier, the silt content of the surface soil,

the number of tillings per year for a given crop and tilling type, and the acres of land tilled for a given crop and tilling type.

$$E = \Sigma c \times k \times s^{0.6} \times p_{crop,tilling\ type} \times a_{crop,tilling\ type}$$

where: E = PM_{10}-FIL or $PM_{2.5}$-FIL emissions

c = constant 4.8 lbs/acre-pass

k = dimensionless particle size multiplier (PM_{10}=0.21; $PM_{2.5}$=0.042)

s = percent silt content of surface soil, defined as the mass fraction of particles smaller than 75 µm diameter found in soil to a depth of 10 cm

p = number of passes or tillings in a year

a = acres of land tilled (activity data)

e. Controls

No controls were accounted for in the emission estimations.

f. 2011 Updates

Since the CTIC has not prepared an updated National Crop Residue Management (CRM) Survey for 2011, activity data for this category were updated using growth factors derived from state-level USDA statistics on various crop types.[5] These growth factors were then matched by state and crop type and applied to the 2008 activity data at the county level. See the table below for how USDA and CRM categories were matched.

Crosswalk between Crop Residue Management Category and USDA Data

CRM Category	USDA Data Items
Barley	BARLEY - ACRES HARVESTED
Beans and Peas	SUM OF BEANS AND PEAS HARVESTED
Canola	CANOLA - ACRES HARVESTED
Corn	CORN, GRAIN - ACRES HARVESTED

CRM Category	USDA Data Items
Cotton	COTTON - ACRES HARVESTED
Cover	TOTAL ACRES HARVESTED
Fallow	TOTAL ACRES HARVESTED
Forage	FORAGE, ALFALFA, HAY - ACRES HARVESTED
Hay	FORAGE (EXCL ALFALFA), HAY - ACRES HARVESTED
Oats	OATS - ACRES HARVESTED
Peanuts	PEANUTS - ACRES HARVESTED
Permanent Pasture	TOTAL ACRES HARVESTED
Potatoes	POTATOES - ACRES HARVESTED
Rice	RICE - ACRES HARVESTED
Rye	RYE - ACRES HARVESTED
Sorghum	SORGHUM, GRAIN - ACRES HARVESTED
Soybeans	SOYBEANS - ACRES HARVESTED
Sugarbeets	SUGARBEETS - ACRES HARVESTED
Sugarcane	SUGARCANE, SUGAR & SEED - ACRES HARVESTED
Sunflower	SUNFLOWER - ACRES HARVESTED
Tobacco	TOBACCO - ACRES HARVESTED
Wheat	WHEAT - ACRES HARVESTED
Winter Wheat	WHEAT, WINTER - ACRES HARVESTED

In addition, for those categories where a specific state/crop combination match was not made, the number of acres tilled were grown using a growth factor based on the total number of farm acres in those states.

g. QA/QC

Missouri audited EPA’s estimate by:

1. Data: Efforts were made to locate references 1 and 2 below in order to verify the following equations:

   $EF = 4.8 \times k \times s^{0.6} \times p_{crop,tilling\ type}$
   $E = \Sigma c \times k \times s^{0.6} \times p_{crop,tilling\ type} \times a_{crop,tilling\ type}$ and

   However, the electronic versions of the references were unable to be located. In the 4th edition of AP-42, the emission factor for PM_{10} was calculated by taking $1.01 * s^{0.6}$, which is quite close to the emission factor from the 1st equation above, when 0.21 is used for the k-value as is specified in the documentation ($1.008 * s^{0.6}$), therefore the equations seem appropriate.

   The Silt Content Table lists the silt content of various soil classifications. The silt contents for Missouri counties appear to be one of two different values, either 28.8 or 52.0. The Silt Content Table indicates, that 52.0 is the silt content for silt loam soil; however no soil classification in the Silt Content Table has a silt content of 28.8. Both clay and clay loam have values of 29% silt content in the Silt Content Table, so it's assumed that the counties in Missouri that were assigned 28.8% silt content have soil classification of one of these two categories. ***Missouri would suggest revising the Silt Content Table, if the value of 28.8% is being used for silt content instead of 29.0%***. Also, the method of picking one soil classification for each county is acceptable if the majority of the cropland in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all cropland in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.***

   USDA quick stats (reference 5) were checked to determine how reasonable the values were for the number of acres tilled in the entire state. USDA data indicates that in 2011 a total of 13,338,000 acres of field crops were harvested. Adding each individual county in the NEI worksheets gives a total of 10,383,135. These values are roughly 25% apart from each other, which raises some concerns, but Missouri is unable to check the data used in the worksheets for accuracy because the CRM county level data is not publicly available. Nonetheless, Missouri accepts EPA's data and has no changes to the NEI results for this source category.

2. Math: In the emissions worksheet the math for several counties was manually spot-checked by multiplying the emission factor by the number of acres tilled and all numbers that were checked manually agreed with the numbers in the table. However, due to the fact that the CRM data is not publicly available, Missouri was unable to verify the calculations used to develop the lbs./acre emission factors for each county. ***If resources permit for future NEIs, Missouri suggests that EPA release the actual calculations for the emissions factor for at least one county in each state so that they can be reviewed and verified at the state level during the QA process.*** Nonetheless, Missouri accepts EPA's calculations and has no changes to the NEI results for this source category.

3. Method: Growth of 2008 crop harvest numbers to 2011 seems like a reasonable method in theory. However, the method of growing 2008 emissions to 2011 emissions based on comparing the 2008 CRM data to the 2011 USDA data could be improved upon by comparing data sets from the same source to ensure consistency in the data sources when developing the growth factors. A quick comparison of 2008 USDA data to 2011 USDA data shows that total field crop acres harvested in Missouri decreased by roughly 350,000 acres (~2.5%), yet when comparing the 2008 emissions sector *Agriculture – Crops and Livestock Dust* to the 2011 NEI for this agriculture-tilling category you will see that emissions in 2011 are calculated at about 1.8% higher than the emissions that were calculated in 2008. Comparing the 2008 and 2011 county level acres tilled data in EPA's worksheets for these two NEIs shows an increase in total acres tilled from

2008 to 2011 for Missouri, which corresponds to the slight increase in the emission estimate for 2011. This increase in total tilled acres is an artifact of the methodology used to create the growth factors by comparing data from two different sources. Nonetheless, Missouri accepts EPA's methodology and has no changes to the NEI results for this source category.

h. References

1. *The Role of Agricultural Practices in Fugitive Dust Emissions*, T.A. Cuscino, Jr., et al., California Air Resources Board, Sacramento, CA, June 1981.

2. Memorandum from Chatten Cowherd of Midwest Research Institute, to Bill Kuykendal of the U.S. Environmental Protection Agency, Emission Factor and Inventory Group, and W.R. Barnard of E.H. Pechan & Associates, Inc., September 1996.

3. *Agricultural Activities Influencing Fine Particulate Matter Emissions*, Woodard, Kenneth R., Midwest Research Institute, March 1996.

4. *National Crop Residue Management Survey*, Conservation Technology Information Center, 2008 http://www.ctic.purdue.edu/CTIC/CTIC.html .

5. USDA Quickstats 2.0, http://quickstats.nass.usda.gov/, Accessed April 2012.

8.3 Agriculture Fertilizer Application

The Missouri DNR accepted EPA's estimates of emissions for this source category. EPA provided no documentation of the category, so the data was checked for reasonableness.

List of SCCs Included:

SCC	Level One	Level Two	Level Three	Level Four
2801700001	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Anhydrous Ammonia
2801700002	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Aqueous Ammonia
2801700003	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Nitrogen Solutions
2801700004	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Urea
2801700005	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Nitrate
2801700006	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Sulfate
2801700007	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Thiosulfate
2801700010	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	N-P-K (multi-grade nutrient fertilizers)
2801700011	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Calcium Ammonium Nitrate
2801700012	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Potassium Nitrate
2801700013	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Diammonium Phosphate
2801700014	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Monoammonium Phosphate
2801700015	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Liquid Ammonium Polyphosphate
2801700099	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Miscellaneous Fertilizers

List of Pollutants:

SourceClassificationCode	PollutantCode
2801700001	NH_3
2801700002	NH_3
2801700003	NH_3
2801700004	NH_3

SourceClassificationCode	PollutantCode
2801700005	NH_3
2801700006	NH_3
2801700007	NH_3
2801700010	NH_3
2801700011	NH_3
2801700012	NH_3
2801700013	NH_3
2801700014	NH_3
2801700015	NH_3
2801700099	NH_3

List of Missouri Counties Included
All but one of Missouri's 115 counties are included in the estimate file. St. Louis City, an urban area, is not included as it has no agricultural activity.

List of Emission Factors
The activity for each SCC and county is listed in the "Reporting Period" table. Combined with the "Emissions" table total emissions field, the emission factor for each SCC can be calculated (it is not explicitly given).

SCC	SCC Level Four	EF	EF Numerator	EF Denominator
2801700001	Anhydrous Ammonia	0.0486	KG	TON
2801700003	Nitrogen Solutions	0.0971	KG	TON
2801700004	Urea	0.182	KG	TON
2801700005	Ammonium Nitrate	0.0243	KG	TON
2801700006	Ammonium Sulfate	0.121	KG	TON
2801700007	Ammonium Thiosulfate	0.0304	KG	TON
2801700010	N-P-K (multi-grade nutrient fertilizers)	0.0243	KG	TON
2801700011	Calcium Ammonium Nitrate	0.0243	KG	TON
2801700013	Diammonium Phosphate	0.0607	KG	TON
2801700014	Monoammonium Phosphate	0.0607	KG	TON
2801700015	Liquid Ammonium Polyphosphate	0.0607	KG	TON
2801700099	Miscellaneous Fertilizers	0.0729	KG	TON

Emission Summary

SCC	SCC Description	2008 NH_3 kg	2011 NH_3 kg	Difference	Percent Difference
2801700001	Anhydrous Ammonia	6,508,195.69	6,667,800.11	159,604.42	2%
2801700003	Nitrogen Solutions	8,222,267.30	5,431,111.59	(2,791,155.71)	-34%
2801700004	Urea	19,551,950.55	18,886,390.18	(665,560.37)	-3%
2801700005	Ammonium Nitrate	1,659,824.69	1,098,153.70	(561,670.99)	-34%
2801700006	Ammonium Sulfate	759,576.49	889,572.72	129,996.23	17%
2801700007	Ammonium Thiosulfate	41,721.99	34,842.65	(6,879.34)	-16%
2801700010	N-P-K (multi-grade nutrient fertilizers)	488,699.96	281,237.57	(207,462.40)	-42%
2801700011	Calcium Ammonium Nitrate	-	355.88	355.88	-
2801700013	Diammonium Phosphate	2,618,123.49	2,146,871.10	(471,252.39)	-18%
2801700014	Monoammonium Phosphate	536,826.86	598,113.86	61,287.00	11%
2801700015	Liquid Ammonium Polyphosphate	60,483.64	72,731.82	12,248.18	20%
2801700099	Miscellaneous Fertilizers	237,664.43	3,048,347.85	2,810,683.41	1183%
	Statewide Total	40,685,335.09	39,155,529.02	(1,529,806.08)	-4%

8.4 Industrial and Commercial/Institutional (ICI) and Residential Fuel Combustion

Missouri worked with CenSARA's contractor who built the entire nonpoint fuel combustion emissions estimate. Documentation is provided in Appendix B-3. The CenSARA tool does not estimate residential wood combustion. Residential Wood Combustion emissions are described in section 8.23.

8.5 Agriculture Livestock Waste

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

Source Category Description

Livestock refers to domesticated animals intentionally reared for the production of food, fiber, or other goods or for the use of their labor. The definition of livestock in this category includes beef cattle, dairy cattle, ducks, geese, goats, horses, poultry, sheep, and swine.

Due to resource constraints at EPA, 2011 emissions are assumed to be the same as 2008 emissions. The approach to calculating emissions for the assigned SCCs consisted of four general steps, as follows:

- Determining county-level population of animals for 2007.
- For beef, dairy, poultry, and swine, apportioning animal populations to a manure management train (MMT) for each county. Animal populations for ducks, geese, goats, horses, and sheep were not apportioned to MMTs.
- Modifying the emission factor files provided with the CMU Ammonia Model v. 3.6 to ensure that every county had an assigned emission factor.[1]
- Using the CMU Ammonia Model v. 3.6 to calculate ammonia emissions based on the updated county-level animal populations and emission factors.

For this source category, the following SCCs were assigned:

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
2805001100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Confinement
2805001200	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Manure handling and storage
2805001300	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Land application of manure

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
2805002000	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle production composite	Not Elsewhere Classified
2805003100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on pasture/range	Confinement
2805007100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Confinement
2805007300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Land application of manure
2805008100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with wet manure management systems	Confinement
2805008200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with wet manure management systems	Manure handling and storage
2805008300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with wet manure management systems	Land application of manure
2805009100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Confinement
2805009200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Manure handling and storage

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
2805009300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Land application of manure
2805010100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Confinement
2805010200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Manure handling and storage
2805010300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Land application of manure
2805018000	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle composite	Not Elsewhere Classified
2805019100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Confinement
2805019200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Manure handling and storage
2805019300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Land application of manure
2805021100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Confinement
2805021200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Manure handling and storage
2805021300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Land application of manure
2805022100	Miscellaneous Area Sources	Agriculture Production -	Dairy cattle - deep pit dairy	Confinement

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
		Livestock		
2805022200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Manure handling and storage
2805022300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Land application of manure
2805023100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Confinement
2805023200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Manure handling and storage
2805023300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Land application of manure
2805025000	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production composite	Not Elsewhere Classified (see also 28-05-039, -047, -053)
2805030000	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Not Elsewhere Classified (see also 28-05-007, -008, -009)
2805030007	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Ducks
2805030008	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Geese
2805035000	Miscellaneous Area Sources	Agriculture Production - Livestock	Horses and Ponies Waste Emissions	Not Elsewhere Classified

SCC	Descriptor 2	Descriptor 4	Descriptor 7	Descriptor 8
2805039100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Confinement
2805039200	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Manure handling and storage
2805039300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Land application of manure
2805040000	Miscellaneous Area Sources	Agriculture Production - Livestock	Sheep and Lambs Waste Emissions	Total
2805045000	Miscellaneous Area Sources	Agriculture Production - Livestock	Goats Waste Emissions	Not Elsewhere Classified
2805047100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Confinement
2805047300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Land application of manure
2805053100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - outdoor operations (unspecified animal age)	Confinement

Activity Data

County-level animal numbers for 2007 were obtained from the U.S. Department of Agriculture's 2007 Census of Agriculture report.[2] For Virginia, the county-level census data includes animal populations

from Virginia's 39 independent cities. For some counties and states, census data was withheld to avoid disclosing data for individual farms. However, the total national-level animal numbers and most state-level animal numbers for each livestock type reported in the Census include those animal numbers not disclosed at the county-level. When available, state-level animal numbers from the USDA NASS online database were used for states with undisclosed animal numbers in the 2007 Census of Agriculture.[3] To determine the total number of undisclosed animals, disclosed county-level animal numbers for each livestock type were summed and subtracted from the total state animal numbers. The total undisclosed animal population for a specific livestock type was then allocated to those counties reporting undisclosed data based on the number of farms raising that livestock in each county.[2] If the state-level data was undisclosed and not available in the NASS database, then national animal numbers were used to determine undisclosed state numbers. The disclosed county-level data was then summed and subtracted from the state-level data to determine animal numbers not disclosed at the county-level. These numbers were then allocated to those counties reporting undisclosed data based on the number of farms raising that livestock in each county.

County-level animal numbers were apportioned to manure management trains. A MMT consists of an animal confinement area (e.g., drylot, pasture, flush, scrape); components used to store, process, or stabilize the manure (e.g., anaerobic lagoons, deep pits); and a land application site where manure is used as a fertilizer source.[4] The apportionment was based on county-level MMT percentages derived from the CMU Ammonia Model. For each livestock type, the county-level number of animals in each MMT was divided by the total county-level animal population for that livestock type to calculate the percentage of total animals managed by each MMT. In cases where the county-level numbers were zero in the 2002 CMU Ammonia Model input files, the county was assigned state-level MMT percentages. The county-level animal population for each livestock type from the 2007 Census of Agriculture was multiplied by the MMT percentages to determine the total number of animals in each MMT in 2007. Animal populations for ducks, geese, goats, horses, and sheep were not apportioned to MMTs.

Cattle reported as "Other Cattle" in the 2007 Census of Agriculture were divided between dairy cattle and beef cattle at the county-level using percent allocations derived from county-level dairy and beef cattle reported in the 2007 Census of Agriculture and corrected for undisclosed data. The animal numbers from "Other Cattle" apportioned to dairy and beef cattle were used to create the Dairy Cattle – Composite and Beef Cattle – Composite activity input files for the CMU Ammonia Model.

County-level pullet numbers reported in the 2007 Census of Agriculture were used to create the Poultry – Composite activity input file for the CMU Ammonia Model.

Emission Factors

The emission factor for the poultry composite categories was obtained from an EPA report and is reported in the corresponding table below.[4] The county-level emission factors for the beef composite and dairy composite categories were developed using beef and dairy cattle emission factors provided with the 2002 CMU Model. Specifically, weighted average emission factors were calculated based on the

number of beef or dairy cattle in each MMT from the 2002 CMU Model activity files and the emission factor assigned to each MMT. All other emission factors were provided with the CMU Ammonia Model v.3.6. The emission factors for some counties in the CMU Ammonia Model files were zero. To ensure that all counties with animal populations were assigned emissions factors, the emission factor input files provided with the CMU Ammonia Model were modified. For all counties with an emission factor of zero, the emission factor was replaced with the state average emission factor. If all counties in the state had emission factors of zero, then the county emission factor was replaced with the national average emission factor. The state average emission factor was calculated by summing the counties with non-zero emission factors in the state and dividing the total by the number of counties in that state with non-zero emission factors. The national average emission factor was calculated by summing the counties with non-zero emission factors in the nation and dividing the total by the number of counties in the nation with non-zero emission factors.

Emissions

The livestock activity files provided with the CMU Ammonia Model v.3.6 were replaced with the updated county-level animal population files and modified emissions files. County-level ammonia emissions were then calculated by running the model.

Sample Calculations

Allocation of Undisclosed Data

From the 2007 Census of Agriculture, the total national number of beef cattle in Alabama is 678,949. The total number of beef cattle disclosed at the county-level is 388,827.

Total number of beef cattle undisclosed at the county-level = 678,949 - 338,827 = 340,122

From the 2007 Census of Agriculture, the total number of farms in Alabama not disclosing beef cattle numbers is 10,518.

Average beef cattle per farm not disclosing data = 340,122 / 10,518 = 32.3

For 2007, Baldwin County, Alabama beef cattle data was not disclosed. The total number of farms with beef cattle in Baldwin County is 343.

Estimated number of beef cattle in Baldwin County = 32.3 x 343 = 11,092

Manure Management Train

From the 2002 CMU Ammonia Model input files, Chilton County, Alabama had 79 beef cattle under drylot management and 18,900 beef cattle under pasture management in 2002.

Total beef cattle = 79 + 18,900 = 18,979

% of beef cattle under drylot management = 79 / 18,979 = 0.42

% of beef cattle under pasture management = 18,900 / 18,979 = 99.58

The total number of beef cattle for Chilton County reported in the 2007 Census of Agriculture is 7,939.

Number of beef cattle under drylot management in 2007 = 7,939 x 0.0042 = 33

Number of beef cattle under pasture management in 2007 = 7,939 x 0.9958 = 7,906

"Other Cattle"

For Clay County, Alabama, the 2007 Census of Agriculture reports the number of "Other Cattle" as 5,471, the number of dairy cattle as 216, and the number of beef cattle as 9,096.

Total beef and dairy cattle reported = 216 + 9,096 = 9,312

% of other cattle assigned to beef cattle = (9,096/9,312)*100 = 97.68

% of other cattle assigned to dairy cattle = (216/9,312)*100 = 2.32

Other cattle allocated to beef cattle = 5,471 x .9768 = 5,344

Other cattle allocated to dairy cattle = 5,471 x 0.0232 = 127

<u>QA/QC</u>

EPA proposes to use 2008 emissions for 2011 emissions due to budget constraints. The 2008 emissions are based upon population data from the 2007 Census of Agriculture. Current estimates of livestock and poultry populations can be obtained from United States Department of Agriculture, National Agricultural Statistics Service, Missouri Field Office.[6] Current estimates for major categories of livestock and poultry populations are general three (3) to ten (10) percent lower than those found in the 2007 census. This population difference is not expected to alter the overall emissions enough to justify running the CMU Ammonia Model v. 3.6.

References

1. Cliff Davidson, Peter Adams, Ross Strader, Rob Pinder, Natalie Anderson, Marian Goebes, and Josh Ayers. The Environmental Institute, Carnegie Mellon University, *CMU Ammonia Model v.3.6*., 2004, at http://www.cmu.edu/ammonia/, accessed 25 April 2009.

2. U.S. Department of Agriculture, *2007 Census of Agriculture*, at http://www.agcensus.usda.gov/, accessed 30 April 2009.

3. U.S. Department of Agriculture, National Agricultural Statistics Service, at http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/, accessed 28 January 2010.

4. U.S. Environmental Protection Agency, *National Emission Inventory – Ammonia Emissions from Animal Agricultural Operations*, Revised Draft Report, 22 April 2005, p. 4-6, at http://www.epa.gov/ttn/chief/net/2002inventory.html, accessed 5 May 2009.

5. Jonathan Dorn, E.H. Pechan & Associates. 2009. A weighted average emission factor calculated using data from the 2002 CMU Ammonia Model v.3.6.

6. U.S. Department of Agriculture, National Agricultural Statistics Service, Missouri Field Office, at http://www.nass.usda.gov/Statistics_by_State/Missouri/Publications/Current_Estimates/index.asp, accessed 7 December 2012.

Livestock Emission Factors

Description	Pollutant Code	Emission Factor	Emission Factor Unit	Emission Factor Reference
Beef Cattle - Composite	NH_3	county-specific	kg NH_3/cow/month	5
Beef Cattle - Drylot Operation - Confinement	NH_3	9.45E-01	kg NH_3/cow/month	1
Beef Cattle - Drylot Operation - Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Beef Cattle - Drylot Operation - Manure Storage	NH_3	3.78E-04	kg NH_3/cow/month	1
Beef Cattle - Pasture Operation - Confinement	NH_3	county-specific	kg NH_3/cow/month	1
Dairy Cattle - Composite	NH_3	county-specific	kg NH_3/cow/month	5
Dairy Cattle - Deep Pit Dairy Confinement	NH_3	2.42E+00	kg NH_3/cow/month	1
Dairy Cattle - Deep Pit Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Deep Pit Dairy Manure Storage	NH_3	1.13E-01	kg NH_3/cow/month	1
Dairy Cattle - Drylot Dairy Confinement	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Drylot Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Drylot Dairy Manure Storage	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Flush Dairy Confinement	NH_3	2.00E+00	kg NH_3/cow/month	1

Description	Pollutant Code	Emission Factor	Emission Factor Unit	Emission Factor Reference
Dairy Cattle - Flush Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Flush Dairy Manure Storage	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Scrape Dairy Confinement	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Scrape Dairy Land Application	NH_3	state-specific	kg NH_3/cow/month	1
Dairy Cattle - Scrape Dairy Manure Storage	NH_3	state-specific	kg NH_3/cow/month	1
Ducks	NH_3	7.67E-02	kg NH_3/duck/month	1
Geese	NH_3	7.67E-02	kg NH_3/goose/month	1
Goats	NH_3	5.29E-01	kg NH_3/goat/month	1
Horses	NH_3	1.02E+00	kg NH_3/horse/month	1
Poultry - Broiler Operation - Confinement	NH_3	8.32E-03	kg NH_3/bird/month	1
Poultry - Broiler Operation - Land Application	NH_3	6.80E-03	kg NH_3/bird/month	1
Poultry - Broiler Operation - Manure Storage	NH_3	1.51E-03	kg NH_3/bird/month	1
Poultry - Composite	NH_3	2.00E-02	kg NH_3/bird/month	4
Poultry - Layers - Dry Manure Operation - Confinement	NH_3	3.36E-02	kg NH_3/bird/month	1
Poultry - Layers - Dry Manure Operation - Land Application	NH_3	county-specific	kg NH_3/bird/month	1
Poultry - Layers - Wet Manure Operation - Confinement	NH_3	9.45E-03	kg NH_3/bird/month	1
Poultry - Layers - Wet Manure Operation - Land Application	NH_3	county-specific	kg NH_3/bird/month	1
Poultry - Layers - Wet Manure Operation - Manure Storage	NH_3	county-specific	kg NH_3/bird/month	1
Poultry - Turkey Operation - Confinement	NH_3	3.78E-02	kg NH_3/bird/month	1
Poultry - Turkey Operation - Land Application	NH_3	3.40E-02	kg NH_3/bird/month	1
Poultry - Turkey Operation - Storage	NH_3	6.80E-03	kg NH_3/bird/month	1
Sheep	NH_3	2.65E-01	kg NH_3/sheep/month	1
Swine - Composite	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Deep Pit Operation - Confinement	NH_3	2.65E-01	kg NH_3/pig/month	1
Swine - Deep Pit Operation - Land Application	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Lagoon Operation - Confinement	NH_3	2.27E-01	kg NH_3/pig/month	1
Swine - Lagoon Operation - Land Application	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Lagoon Operation - Manure Storage	NH_3	county-specific	kg NH_3/pig/month	1
Swine - Outdoor Operation - Confinement	NH_3	county-specific	kg NH_3/pig/month	1

8.6 Aviation Gasoline Distribution: Stage I

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Aviation gasoline (also called "AvGas") is the only aviation fuel that contains tetraethyl lead (TEL) as a knock-out component for small reciprocating, piston-engine crafts in civil aviation.[1] Commercial and military aviation rarely use this fuel. AvGas is shipped to airports and is filled into bulk terminals, and then into tanker trucks. These processes fall under the definition of stage I, displacement vapors during the transfer of gasoline from tank trucks to storage tanks, and vice versa. These processes are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution.[2]

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2501080050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 1: Total

b. Activity Data

The amount of AvGas consumed was obtained from the Petroleum Supply Annual for designated Petroleum Administration Districts, or PADs.[3] A nationwide total of 5,603,000 barrels of AvGas were consumed in 2008.[3] (The EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited resources.) This information was used to calculate national-level emissions estimates for one criteria pollutant and ten hazardous air pollutants (HAPs). Assumptions for bulk plant processes are summarized in the corresponding table below.

c. Emission Factors

Emission factors were provided by ESD and EIG publications.[1,4,5,6]

d. Emissions

In general, national-level emissions were calculated by multiplying AvGas consumption by the appropriate emission factors and then summing emissions. The national-level emission estimates were

first allocated based on consumption reported for each PAD, and then allocated to the counties within the PADs based on 2008 Landing-Take Off (LTO) data for general aviation flights.[7] General aviation flights were used in this allocation because they are the primary consumers of AvGas.

There are five PADs across the United States[3]

PAD 1 comprises seventeen states plus the District of Columbia along the Atlantic Coast;
PAD 2 comprises fifteen states in the Midwest;
PAD 3 comprises six states in South Central U.S.;
PAD 4 comprises five states in the Rocky Mountains; and
PAD 5 comprises seven states along the West Coast.

Summary of AvGas Consumed and LTOs by PAD in 2008

PAD	AvGas Consumed (barrels)	LTOs
1	1,039,000	17,588,837
2	1,652,000	16,520,073
3	2,021,000	9,883,668
4	158,000	3,311,438
5	733,000	12,641,441
	5,603,000	**59,945,457**

e. Sample Calculations

National-Level Calculations

Amount of AvGas consumed in 2008 (barrels) = 5,603,000

Conversion: *1 barrel = 42 gallons*

1 gallon = 3.78 liters

1 kg = 2.205 lb

1 kg = 1,000,000 mg

1 ton = 2000 lb

Step 1 - Convert AvGas consumption into gallons using conversion factors.

Amount of AvGas consumed in 2008 (gallons) = 5,603,000 barrels * 42 gallons/barrel
Amount of AvGas consumed in 2008 (gallons) = 235,326,000

Step 2 - Use the gallons of AvGas consumed and apply the non-fugitive VOC emission factors in the corresponding table below to calculate non-fugitive VOC estimates.

Unloading/Tank Filling: tank fill VOC emissions = 0.009021383 LB/GAL * 235,326,000 GAL / 2,000 LB/TON
Unloading/Tank Filling: tank fill VOC emissions = **1,061.48** tpy

Unloading/Tank Filling: Storage tank VOC emissions = 0.003605215 LB/GAL * 235,326,000 GAL / 2,000 LB/TON
Unloading/Tank Filling: Storage tank VOC emissions = **424.20** tpy

Tank Truck Filling - Composite VOC Emissions = 0.010306575 LB/GAL * 235,326,000 GAL * / 2,000 LB/TON
Tank Truck Filling - Composite VOC Emissions = **1,212.70** tpy

Storage Tank - Breathing losses VOC Emissions = 0.001694117 LB/GAL * 235,326,000 GAL * / 2,000 LB/TON
Storage Tank - Breathing losses VOC Emissions = **199.33** tpy

Total non-fugitive VOC emissions = 1,061.48 tpy + 424.20 tpy + 1,212.70 tpy + 199.33 tpy = **2,897.72** tpy

Step 3 - Use the assumptions in and the fugitive VOC emission factors in the corresponding tables below to generate fugitive VOC emissions.

AvGas - Fugitive from valves VOC Emissions = (# Bulk Plant Equivalents)*(#valves/plant)*EF*days
AvGas - Fugitive from valves VOC Emissions = (2442 plants) * (50 valves/plant) * (0.573201882 LB/valve/day)* 300 days / 2,000 LB/TON

AvGas - Fugitive from valves VOC Emissions = **10,498.19** tpy

AvGas - Fugitive from pumps VOC Emissions = (# Bulk Plant Equivalents)*(#pumps/plant)* (#seals/pump) * EF * days

AvGas - Fugitive from pumps VOC Emissions = (2442 plants) * (2 pumps/plant) * (4 seals/pump) * (5.952481079 LB/seal/day)* 300 days / 2,000 LB/TON

AvGas - Fugitive from pumps VOC Emissions = **17,443.15** tpy

Total fugitive VOC emissions = 10,498.19 tpy + 17,443.15 tpy

Total fugitive VOC emissions = **27,941.34** tpy

Step 4 - Sum the fugitive and non-fugitive VOC emissions together for total VOC emissions.

Total VOC emissions = 2,897.72 tpy + 27,941.34 tpy = **30,839.06** tpy

Step 5 - Apply the speciation emission factors in the corresponding table below for tetraethyl lead, 2,2,4-trimethylpentane, benzene, cumene, ethylbenzene, hexane, naphthalene, toluene, and xylene to calculate HAP emissions.

Tetraethyl Lead emissions = 30,839.06 tpy VOC * 9.78 E-6 = **0.30** tpy
2,2,4-Trimethylpentane emissions = 30,839.06 tpy VOC * 0.008 = **246.71** tpy
Benzene emissions = 30,839.06 tpy VOC * 0.009 = **277.55** tpy
Cumene emissions = 30,839.06 tpy VOC * 0.0001 = **3.08** tpy
Ethylbenzene emissions = 30,839.06 tpy VOC * 0.0010 = **30.84** tpy
Hexane emissions = 30,839.06 tpy VOC * 0.0160 = **493.43** tpy
Naphthalene emissions = 30,839.06 tpy VOC * 0.0005 = **15.42** tpy
Toluene emissions = 30,839.06 tpy VOC * 0.0130 = **400.91** tpy
Xylene emissions = 30,839.06 tpy VOC * 0.005 = **154.20** tpy

Step 6 - Use the ethylene dichloride emission factor in the corresponding table below to calculate ethylene dichloride emissions.

Ethylene dichloride emissions = 235,326,000 GAL * 2.167E-6 LB/GAL * TON/2000 LB = **0.25** tpy

Assumptions Used For Bulk Terminals Using AvGas

Parameter	Data	Reference
Number of Bulk Plant Equivalents (U.S.)	2,442 plants	1
Number of valves per bulk plant	50 valves/plant	
Number of pumps per bulk plant	2 pumps/plant	
Number of seals per bulk plant	4 seals/pump	
Number of days per year used	300 days	

VOC Emission Factors

Pollutant	Emission Source	Emission Factor	Emission Factor Units	Factor Reference
VOC	Aviation Gas Unloading/ Tank Filling - tank fill	0.009021383	LB/GAL AvGas	1
	Aviation Gas Unloading/ Tank Filling - Storage tank working	0.003605215		
	Aviation Gas Tank Truck Filling - Composite	0.010306575		
	Aviation Gas Storage Tank - Breathing losses	0.001694117		
	Aviation Gas - Fugitive from valves	0.573201882	LB/valve/day	
	Aviation Gas - Fugitive from pumps	5.952481079	LB/seal/day	

HAP Emission Factors

Pollutant	Emission Source	Emission Factor	Emission Factor Units	Factor Reference
Ethylene Dichloride	All processes	2.167 E-6	LB/GAL AvGas	4
Tetraethyl Lead (TEL)	All processes	9.78 E-6	LB/LB VOC	1
2,2,4-Trimethylpentane	All processes	0.0080	LB/ LB VOC	
Benzene	All processes	0.0090		5
Cumene	All processes	0.0001		6
Ethylbenzene	All processes	0.0010		
Hexane	All processes	0.0160		
Naphthalene	All processes	0.0005		
Toluene	All processes	0.0130		
Xylene	All processes	0.0050		5

<u>Example Calculations for Wake County, NC</u>

Wake County VOC emissions = (National VOC emissions) * (PAD 1 consumption/Total consumption) * (Wake County LTOs/PAD 1 LTOs)

Wake County VOC emissions = (30,839.06 tpy) * (1,039,000 bbl/5,603,000 bbl) * (95,234 LTOs/17,588,837 LTOs)

Wake County VOC emissions = **30.96** tpy

Wake County Benzene Emissions = (Wake County VOC emissions)*(Benzene Emission Factor)

Wake County Benzene Emissions = (30.96 tpy VOC) * (0.0090 LB benzene/ LB VOC)* (2000 LB VOC/2000 LB benzene)

Wake County Benzene Emissions = **0.28** tpy

f. References

1. TRC Environmental Corporation. *Estimation of Alkylated Lead Emissions, Final Report*. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. RTP, NC 1993.

2. U.S. Environmental Protection Agency. National Emission Standards for Source Categories: Gasoline Distribution (Stage I). 40 CFR Part 63. Office of Air Quality Planning and Standards. RTP, NC. February 28, 1997. Pages 9087-9093.

3. Energy Information Administration. *Petroleum Annual Supply, 2008*. Tables 3, 5, 7, 9, and 11. U.S. Department of Energy. Washington, D.C. June 2009. (Internet address: http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1.html)

4. U.S. Environmental Protection Agency. *Locating and Estimating Air Emissions from Sources of Ethylene Dichloride*. EPA-450/4-84-007d. RTP, NC. March 1984.

5. Memorandum from Greg LaFlam and Tracy Johnson (PES) to Stephen Shedd (EPA/OAQPS). *Speciated Hazardous Air Pollutants - Baseline Emissions and Emissions Reductions Under the Gasoline Distribution NESHAP*. August 9, 1996.

6. Personal Communication via e-mail from Stephen Shedd (EPA/OAQPS) to Laurel Driver (EPA/OAQPS). E-mail dated May 29, 2002.

7. [LTObyCtyandSCC.mdb], electronic file from Laurel Driver, U.S. Environmental Protection Agency, OAQPS, to U.S. Environmental Protection Agency, OAQPS, November 12, 2009. Aircraft operations data compiled from FAA's Terminal Area Forecasts (TAF) and 5010 Forms.

8.7 Aviation Gasoline Distribution: Stage II

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Aviation gasoline (also called "AvGas") is the only aviation fuel that contains tetraethyl lead (TEL) as a knock-out component for small reciprocating, piston-engine crafts in civil aviation.[1] Commercial and military aviation rarely use this fuel. AvGas is shipped to airports and is filled into bulk terminals, and then into tanker trucks. These processes fall under the definition of stage I are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution.[2] Stage II, discussed here, involves the transfer of fuel from the tanker trucks into general aviation aircraft.

For this source category, the following SCC was assigned:

SCC	**SCC Level 1**	**SCC Level 2**	**SCC Level 3**	**SCC Level 4**
2501080100	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 2: Total

b. Activity Data

The amount of AvGas consumed was obtained from the Petroleum Supply Annual for designated Petroleum Administration Districts, or PADs.[3] A nationwide total of 5,603,000 barrels of AvGas were consumed in 2008.[3] (The EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited resources.) This information was used to calculate national-level emissions estimates for one criteria pollutant and ten hazardous air pollutants (HAPs).

c. Emission Factors

Emission factors were provided by ESD and EIG publications.[1,4,5,6]

d. Emissions

In general, national-level emissions were calculated by multiplying AvGas consumption by the appropriate emission factors and then summing emissions. The national-level emission estimates were first allocated based on consumption reported for each PAD, and then allocated to the counties within the PADs based on 2008 Landing-Take Off (LTO) data for general aviation flights.[7] General aviation flights were used in this allocation because they are the primary consumers of AvGas.

There are five PADs across the United States[3]

PAD 1 comprises seventeen states plus the District of Columbia along the Atlantic Coast;
PAD 2 comprises fifteen states in the Midwest;
PAD 3 comprises six states in South Central U.S.;
PAD 4 comprises five states in the Rocky Mountains; and
PAD 5 comprises seven states along the West Coast.

Summary of AvGas Consumed and LTOs by PAD in 2008

PAD	AvGas Consumed (barrels)	LTOs
1	1,039,000	17,588,837
2	1,652,000	16,520,073
3	2,021,000	9,883,668
4	158,000	3,311,438
5	733,000	12,641,441
	5,603,000	**59,945,457**

e. Sample Calculations

National-Level Calculations

Amount of AvGas consumed in 2008 (barrels) = 5,603,000

Conversion: *1 barrel = 42 gallons*

1 gallon = 3.78 liters

1 kg = 2.205 lb

1 kg = 1,000,000 mg

1 ton = 2000 lb

Step 1 - Convert AvGas consumption into gallons using conversion factors.

Amount of AvGas consumed in 2008 (gallons) = 5,603,000 barrels * 42 gallons/barrel
Amount of AvGas consumed in 2008 (gallons) = 235,326,000

Step 2 - Use the gallons of AvGas consumed and apply the refueling VOC emission factors from the corresponding table below to first calculate refueling VOC estimates.

AvGas Refueling VOC emissions = (1.36 E-2 LB/gal AvGas) * 235,326,000 gallons * 1 ton/2000 LB

AvGas Refueling VOC emissions = **1,600.22** tpy

Step 3 - Apply the speciation emission factors in the corresponding table below for 2,2,4-trimethylpentane, benzene, cumene, ethylbenzene, hexane, naphthalene, toluene, and xylene to calculate HAP emissions.

2,2,4-Trimethylpentane emissions = 1,600.22 tpy VOC * 0.008 = **12.80** tpy
Benzene emissions = 1,600.22 tpy VOC * 0.009 = **14.40** tpy
Cumene emissions = 1,600.22 tpy VOC * 0.0001 = **0.16** tpy
Ethylbenzene emissions = 1,600.22 tpy VOC * 0.0010 = **1.60** tpy
Hexane emissions = 1,600.22 tpy VOC * 0.0160 = **25.60** tpy
Naphthalene emissions = 1,600.22 tpy VOC * 0.0005 = **0.80** tpy
Toluene emissions = 1,600.22 tpy VOC * 0.0130 = **20.80** tpy
Xylene emissions = 1,600.22 tpy VOC * 0.005 = **8.00** tpy

Step 6 - Use the ethylene dichloride and tetraethyl lead emission factors in the corresponding table below to calculate ethylene dichloride emissions.

Ethylene dichloride emissions = 235,326,000 GAL * 1.883 E-6 LB/GAL * TON/2000 LB = **0.22** tpy
Tetraethyl lead emissions = 235,326,000 GAL * 1.327E-7 LB/GAL * TON/2000 LB = **0.015** tpy

VOC Emission Factor

Pollutant	Emission Source	Emission Factor	Emission Factor Units	Factor Reference
VOC	Fuel Transfer from Tanker Trucks to General Aviation Aircraft	0.0136	LB/GAL AvGas	1

HAP Emission Factors

<table>
<tr><th>Pollutant</th><th>Emission Source</th><th>Emission Factor</th><th>Emission Factor Units</th><th>Factor Reference</th></tr>
<tr><td>Ethylene Dichloride</td><td>All processes</td><td>1.883 E-6</td><td>LB/GAL AvGas</td><td>4</td></tr>
<tr><td>Tetraethyl Lead (TEL)</td><td>All processes</td><td>1.327 E-7</td><td>LB/GAL AvGas</td><td>1</td></tr>
<tr><td>2,2,4-Trimethylpentane</td><td>All processes</td><td>0.0080</td><td rowspan="9">LB/ LB VOC</td><td rowspan="2">5</td></tr>
<tr><td>Benzene</td><td>All processes</td><td>0.0090</td></tr>
<tr><td>Cumene</td><td>All processes</td><td>0.0001</td><td>6</td></tr>
<tr><td>Ethylbenzene</td><td>All processes</td><td>0.0010</td><td rowspan="6">5</td></tr>
<tr><td>Hexane</td><td>All processes</td><td>0.0160</td></tr>
<tr><td>Naphthalene</td><td>All processes</td><td>0.0005</td></tr>
<tr><td>Toluene</td><td>All processes</td><td>0.0130</td></tr>
<tr><td>Xylene</td><td>All processes</td><td>0.0050</td></tr>
</table>

<u>Example Calculations for Wake County, NC</u>

Wake County VOC emissions = (National VOC emissions) * (PAD 1 consumption/Total consumption) * (Wake County LTOs/PAD 1 LTOs)

Wake County VOC emissions = (1,600.22 tpy) * (1,039,000 bbl/5,603,000 bbl) * (95,234 LTOs/17,588,837 LTOs)

Wake County VOC emissions = **1.61** tpy

Wake County Benzene Emissions = (Wake County VOC emissions)*(Benzene Emission Factor)

Wake County Benzene Emissions = (1.61 tpy VOC) * (0.0090 LB benzene/ LB VOC)* (2000 lb VOC/2000 lb benzene)

Wake County Benzene Emissions = **0.014** tpy

f. References

1. TRC Environmental Corporation. *Estimation of Alkylated Lead Emissions, Final Report*. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. RTP, NC 1993.

2. U.S. Environmental Protection Agency. National Emission Standards for Source Categories: Gasoline Distribution (Stage I). 40 CFR Part 63. Office of Air Quality Planning and Standards. RTP, NC. February 28, 1997. Pages 9087-9093.

3. Energy Information Administration. *Petroleum Annual Supply, 2008*. Tables 3, 5, 7, 9, and 11. U.S. Department of Energy. Washington, D.C. June 2009. (Internet address: http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1.html)

4. U.S. Environmental Protection Agency. *Locating and Estimating Air Emissions from Sources of Ethylene Dichloride*. EPA-450/4-84-007d. RTP, NC. March 1984.

5. Memorandum from Greg LaFlam and Tracy Johnson (PES) to Stephen Shedd (EPA/OAQPS). *Speciated Hazardous Air Pollutants - Baseline Emissions and Emissions Reductions Under the Gasoline Distribution NESHAP*. August 9, 1996.

6. Personal Communication via e-mail from Stephen Shedd (EPA/OAQPS) to Laurel Driver (EPA/OAQPS). E-mail dated May 29, 2002.

7. [LTObyCtyandSCC.mdb], electronic file from Laurel Driver, U.S. Environmental Protection Agency, OAQPS, to U.S. Environmental Protection Agency, OAQPS, November 12, 2009. Aircraft operations data compiled from FAA's Terminal Area Forecasts (TAF) and 5010 Forms.

8.8 Commercial Cooking

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection f contains Missouri's audit of EPA's estimate.

a. Source Category Description

Commercial cooking emissions are for five source categories based on equipment type. Emissions estimates are for all types of meat cooked in a particular piece of equipment. Deep fat frying of french fries was also included.

For this source category, the following SCCs were assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Conveyorized Charbroiling
2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Under-fired Charbroiling
2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Deep Fat Frying
2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Flat Griddle Frying
2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Clamshell Griddle Frying

b. Emission Factors and Equation

The emission factors used to estimate commercial cooking emissions for the 2011 NEI were developed by dividing SCC and pollutant-specific national emissions from the 2002 NEI by 2002 population to obtain per capita emission factors for each SCC and pollutant. These emission factors were developed

and reviewed by an ERTAC advisory panel composed of state and EPA personnel (Contact: Roy Huntley, huntley.roy@epa.gov). The PM-CON emission factors were derived by subtracting PM_{10}-FIL from PM_{10}-PRI and the $PM_{2.5}$-PRI emission factors were derived by adding $PM_{2.5}$-FIL and PM-CON. The resulting emission factors are listed in the corresponding table below.

c. Activity Data

The activity data used to estimate emissions from commercial cooking was 2010 county-level population data, which was obtained from the US Census Bureau's county-level population estimates for the 2010 Census.[1] The per capita emission factors were then multiplied by the 2010 county-level population estimates.

d. Control Factors

While no control factors were directly applied to develop the 2011 NEI, the 2002 emissions used to calculate the per capita emission factors used in the 2011 NEI include controls on chain-driven commercial charbroiling in the South Coast Air Quality Management District (SCAQMD) in California. Thus, the effect of these controls from the 2002 NEI will lead to slightly lower emissions nationwide in this category for the 2011 NEI, rather than a more substantial reduction in emissions just in the SCAQMD area.

e. Sample Calculations

Emissions are calculated for each county using emission factors and activity as:

$$E_{x,p} = A_x \times EF_{x,p}$$

where:

$E_{x,p}$ = annual emissions for category x and pollutant p;

A_x = 2010 county-level population data associated with category x;

$EF_{x,p}$ = emission factor for category x and pollutant p (lb/person).

Example:

Using conveyorized charbroiling in Allegheny County, PA as an example:

According to the US Census Bureau, the population on April 1, 2010 is 1,223,348

The emission factor for PM_{10}-PRI is 0.0498 lb/person

$E_{PM10\text{-}PRI}$ = 1,223,348 people × 0.0498 lb PM_{10}-PRI/person

= 60,918 lb PM_{10}-PRI or 30.5 ton PM_{10}-PRI

f. QA/QC

1. Source Data – population, EF
   Population data listed in the spreadsheet and database were compared to 2010 Missouri population data listed on the US Census Bureau's website and is accurate both at the county level in total population.

2. Calculations
   Calculations for Missouri county emissions using the per capita emission factors and county populations were checked and confirmed to be accurate using Excel functions and comparisons.

3. Overall – This is a sound method for estimating emissions from commercial cooking facilities. Missouri has no more specific EF or county-allocation methods.

g. References

1. DOC, 2011: U.S. Department of Commerce, Bureau of the Census, *County Intercensal Estimates (2000-2010)*, Washington, DC. http://www.census.gov/popest/data/intercensal/county/county2010.html

Commercial Cooking Emission Factors Developed by ERTAC

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302002100	Conveyorized Charbroiling	100027	1.326E-05	LB	EACH
2302002200	Under-fired Charbroiling	100027	6.385E-05	LB	EACH
2302002100	Conveyorized Charbroiling	100414	7.668E-05	LB	EACH
2302002200	Under-fired Charbroiling	100414	5.312E-04	LB	EACH
2302002100	Conveyorized Charbroiling	100425	3.730E-04	LB	EACH
2302002200	Under-fired Charbroiling	100425	2.747E-03	LB	EACH
2302002100	Conveyorized Charbroiling	106445	7.003E-06	LB	EACH
2302002200	Under-fired Charbroiling	106445	4.214E-05	LB	EACH
2302002100	Conveyorized Charbroiling	107062	2.682E-05	LB	EACH
2302002200	Under-fired Charbroiling	107062	2.183E-04	LB	EACH
2302002100	Conveyorized Charbroiling	108883	3.597E-04	LB	EACH
2302002200	Under-fired Charbroiling	108883	2.496E-03	LB	EACH
2302002100	Conveyorized Charbroiling	108952	4.421E-05	LB	EACH
2302002200	Under-fired Charbroiling	108952	3.063E-04	LB	EACH
2302002100	Conveyorized Charbroiling	120127	5.943E-06	LB	EACH
2302002200	Under-fired Charbroiling	120127	1.914E-05	LB	EACH
2302003100	Flat Griddle Frying	120127	8.487E-06	LB	EACH
2302002100	Conveyorized Charbroiling	123386	1.466E-04	LB	EACH
2302002200	Under-fired Charbroiling	123386	1.113E-03	LB	EACH
2302002100	Conveyorized Charbroiling	129000	8.852E-06	LB	EACH
2302002200	Under-fired Charbroiling	129000	3.587E-05	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302003100	Flat Griddle Frying	129000	3.139E-05	LB	EACH
2302002100	Conveyorized Charbroiling	130498292	2.709E-04	LB	EACH
2302002200	Under-fired Charbroiling	130498292	7.911E-04	LB	EACH
2302003100	Flat Griddle Frying	130498292	2.589E-04	LB	EACH
2302002100	Conveyorized Charbroiling	1330207	7.799E-07	LB	EACH
2302002200	Under-fired Charbroiling	1330207	1.560E-06	LB	EACH
2302002100	Conveyorized Charbroiling	191242	1.309E-06	LB	EACH
2302002200	Under-fired Charbroiling	191242	2.542E-06	LB	EACH
2302002100	Conveyorized Charbroiling	193395	1.278E-06	LB	EACH
2302002200	Under-fired Charbroiling	193395	1.723E-06	LB	EACH
2302002100	Conveyorized Charbroiling	206440	6.484E-06	LB	EACH
2302002200	Under-fired Charbroiling	206440	2.638E-05	LB	EACH
2302003100	Flat Griddle Frying	206440	2.371E-05	LB	EACH
2302002100	Conveyorized Charbroiling	208968	2.476E-05	LB	EACH
2302002200	Under-fired Charbroiling	208968	6.372E-05	LB	EACH
2302003100	Flat Griddle Frying	208968	4.886E-06	LB	EACH
2302002100	Conveyorized Charbroiling	50000	7.796E-04	LB	EACH
2302002200	Under-fired Charbroiling	50000	5.876E-03	LB	EACH
2302002100	Conveyorized Charbroiling	50328	1.450E-06	LB	EACH
2302002200	Under-fired Charbroiling	50328	2.332E-06	LB	EACH
2302003100	Flat Griddle Frying	50328	1.154E-06	LB	EACH
2302002100	Conveyorized Charbroiling	56553	1.772E-06	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302002200	Under-fired Charbroiling	56553	5.432E-06	LB	EACH
2302003100	Flat Griddle Frying	56553	2.918E-06	LB	EACH
2302002100	Conveyorized Charbroiling	71432	1.006E-03	LB	EACH
2302002200	Under-fired Charbroiling	71432	7.351E-03	LB	EACH
2302002100	Conveyorized Charbroiling	75070	5.562E-04	LB	EACH
2302002200	Under-fired Charbroiling	75070	4.242E-03	LB	EACH
2302002100	Conveyorized Charbroiling	83329	1.613E-06	LB	EACH
2302002200	Under-fired Charbroiling	83329	2.776E-06	LB	EACH
2302003100	Flat Griddle Frying	83329	1.357E-06	LB	EACH
2302002100	Conveyorized Charbroiling	84742	4.140E-06	LB	EACH
2302002200	Under-fired Charbroiling	84742	2.413E-05	LB	EACH
2302002100	Conveyorized Charbroiling	85018	2.771E-05	LB	EACH
2302002200	Under-fired Charbroiling	85018	8.647E-05	LB	EACH
2302003100	Flat Griddle Frying	85018	6.021E-05	LB	EACH
2302002100	Conveyorized Charbroiling	86737	6.408E-06	LB	EACH
2302002200	Under-fired Charbroiling	86737	2.003E-05	LB	EACH
2302003100	Flat Griddle Frying	86737	6.484E-06	LB	EACH
2302002100	Conveyorized Charbroiling	91203	1.135E-04	LB	EACH
2302002200	Under-fired Charbroiling	91203	2.649E-04	LB	EACH
2302003100	Flat Griddle Frying	91203	1.308E-04	LB	EACH
2302002100	Conveyorized Charbroiling	92524	1.271E-05	LB	EACH
2302002200	Under-fired Charbroiling	92524	2.613E-05	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302003100	Flat Griddle Frying	92524	2.788E-06	LB	EACH
2302002100	Conveyorized Charbroiling	95476	6.167E-05	LB	EACH
2302002200	Under-fired Charbroiling	95476	4.387E-04	LB	EACH
2302002100	Conveyorized Charbroiling	95487	3.482E-06	LB	EACH
2302002200	Under-fired Charbroiling	95487	2.111E-05	LB	EACH
2302002100	Conveyorized Charbroiling	98862	4.991E-06	LB	EACH
2302002200	Under-fired Charbroiling	98862	3.250E-05	LB	EACH
2302002100	Conveyorized Charbroiling	CO	4.245E-02	LB	EACH
2302002200	Under-fired Charbroiling	CO	1.350E-01	LB	EACH
2302003000	Deep Fat Frying	CO	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	CO	1.269E-02	LB	EACH
2302003200	Clamshell Griddle Frying	CO	0.000E+00	LB	EACH
2302002200	Under-fired Charbroiling	NO_X	0.000E+00	LB	EACH
2302002100	Conveyorized Charbroiling	PM_{10}-FIL	1.648E-04	LB	EACH
2302002200	Under-fired Charbroiling	PM_{10}-FIL	1.048E-03	LB	EACH
2302003100	Flat Griddle Frying	PM_{10}-FIL	2.727E-04	LB	EACH
2302003200	Clamshell Griddle Frying	PM_{10}-FIL	1.981E-05	LB	EACH
2302002100	Conveyorized Charbroiling	PM_{10}-PRI	4.980E-02	LB	EACH
2302002200	Under-fired Charbroiling	PM_{10}-PRI	3.528E-01	LB	EACH
2302003000	Deep Fat Frying	PM_{10}-PRI	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	PM_{10}-PRI	1.031E-01	LB	EACH
2302003200	Clamshell Griddle Frying	PM_{10}-PRI	6.994E-03	LB	EACH

SCC	SCC description	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
2302002100	Conveyorized Charbroiling	$PM_{2.5}$-FIL	1.597E-04	LB	EACH
2302002200	Under-fired Charbroiling	$PM_{2.5}$-FIL	1.013E-03	LB	EACH
2302003100	Flat Griddle Frying	$PM_{2.5}$-FIL	2.074E-04	LB	EACH
2302003200	Clamshell Griddle Frying	$PM_{2.5}$-FIL	1.685E-05	LB	EACH
2302002100	Conveyorized Charbroiling	$PM_{2.5}$-PRI	4.979E-02	LB	EACH
2302002200	Under-fired Charbroiling	$PM_{2.5}$-PRI	3.527E-01	LB	EACH
2302003000	Deep Fat Frying	$PM_{2.5}$-PRI	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	$PM_{2.5}$-PRI	1.030E-01	LB	EACH
2302003200	Clamshell Griddle Frying	$PM_{2.5}$-PRI	6.991E-03	LB	EACH
2302002100	Conveyorized Charbroiling	PM-CON	4.963E-02	LB	EACH
2302002200	Under-fired Charbroiling	PM-CON	3.517E-01	LB	EACH
2302003000	Deep Fat Frying	PM-CON	0.000E+00	LB	EACH
2302003100	Flat Griddle Frying	PM-CON	1.028E-01	LB	EACH
2302003200	Clamshell Griddle Frying	PM-CON	6.974E-03	LB	EACH
2302002200	Under-fired Charbroiling	SO_2	0.000E+00	LB	EACH
2302002100	Conveyorized Charbroiling	VOC	1.206E-02	LB	EACH
2302002200	Under-fired Charbroiling	VOC	4.148E-02	LB	EACH
2302003000	Deep Fat Frying	VOC	1.261E-02	LB	EACH
2302003100	Flat Griddle Frying	VOC	5.943E-03	LB	EACH
2302003200	Clamshell Griddle Frying	VOC	2.316E-04	LB	EACH

8.9 Fugitive Dust: Construction Activities Roads

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Missouri's audit of EPA's estimate can be found near the end of this section.

a. Source Category Description

Emissions from road construction activity are a function of the acreage disturbed for road construction. Road construction activity is developed from data obtained from the Federal Highway Administration (FHWA). Fugitive dust emissions from road construction were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2311030000	Industrial Processes	Construction: SIC 15 - 17	Road Construction	Total

b. Activity Data

The Federal Highway Administration has *Highway Statistics, Section IV - Highway Finance, Table SF-12A, State Highway Agency Capital Outlay*[1] for 2008 which outlines spending by state in several different categories. For this SCC, the following columns are used: New Construction, Relocation, Added Capacity, Major Widening, and Minor Widening. These columns are also differentiated according to the following six classifications:

1. Interstate, urban
2. Interstate, rural
3. Other arterial, urban
4. Other arterial, rural
5. Collectors, urban
6. Collectors, rural

The State expenditure data are then converted to new miles of road constructed using $/mile conversions obtained from the North Carolina Department of Transportation (NCDOT) in 2000. A conversion of $4

million/mile is applied to the interstate expenditures. For expenditures on other arterial and collectors, a conversion factor of $1.9 million/mile is applied, which corresponds to all other projects.

The new miles of road constructed are used to estimate the acreage disturbed due to road construction. The total area disturbed in each state is calculated by converting the new miles of road constructed to acres using an acres disturbed/mile conversion factor for each road type as given in the table below:

Spending per Mile and Acres Disturbed per Mile by Highway Type

Road Type	Thousand Dollars per mile	Total Affected Roadway Width (ft)*[3]	Acres Disturbed per mile[3]
Urban Areas, Interstate	4,000	125	15.2
Rural Areas, Interstate	4,000	125	15.2
Urban Areas, Other Arterials	1,900	125	15.2
Rural Areas, Other Arterials	1,900	105	12.7
Urban Areas, Collectors	1,900	81	9.8
Rural Areas, Collectors	1,900	65	7.9
*Total Affected Roadway Width = (lane width (12 ft) * number of lanes) + (shoulder width * number of shoulders) + area affected beyond road width (25 ft)			

The acres disturbed per mile data shown in the table above is calculated by multiplying the total affected roadway width (including all lanes, shoulders, and areas affected beyond the road width) by one mile and converting the resulting land area to acres. Building permits[2] are used to allocate the state-level acres disturbed by road construction to the county. A ratio of the number of building starts in each county to the total number of building starts in each state is applied to the state-level acres disturbed to estimate the total number of acres disturbed by road construction in each county.

c. Emission Factors

Initial PM_{10} emissions from construction of roads are calculated using an emission factor of 0.42 tons/acre-month.[3] This emission factor represents the large amount of dirt moved during the construction of roadways, reflecting the high level of cut and fill activity that occurs at road construction sites. The duration of construction activity for road construction is assumed to be 12 months.

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM_{10} emissions from road construction to develop the final emissions inventory.

To account for the soil moisture level, the PM_{10} emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite's PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.[3]

To account for the silt content, the PM_{10} emissions are weighted using average silt content for each county. A data base containing county-level dry silt values was complied. These values were derived by

applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.[4]

The equation for PM_{10} emissions corrected for soil moisture and silt content is:

$$Corrected\ E_{PM10} = Initial\ \mathrm{E}_{PM10} \times \frac{24}{PE} \times \frac{S}{9\%}$$

where: Corrected E_{PM10} = PM_{10} emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM_{10} adjustments have been made, $PM_{2.5}$ emissions are set to 10% of PM_{10}. Primary PM emissions are equal to filterable emissions since there are no condensable emissions from road construction.

d. Example Calculation

$\mathrm{Emissions}_{PM10} = \sum(HD_{rt} \times MC_{rt} \times AC_{rt}) \times (HS_{County} / HS_{State}) \times EF_{Adj} \times M$

Where HD_{rt} = Highway Spending for a specific road type

MC_{rt} = Mileage conversion for a specific road type

AC_{rt} = Acreage conversion for a specific road type

HS_{County} = Housing Starts in a given county

HS_{State} = Housing Starts in a given State

EF_{Adj} = Adjusted PM_{10} Emission Factor

M = duration of construction activity

As an example in 2010, in Newport County, Rhode Island, acres disturbed and PM_{10} emissions from urban interstate and urban other arterial road construction are calculated as follows:

$\mathrm{Emissions}_{PM10} = \sum(HD_{rt} \times MC_{rt} \times AC_{rt}) \times (HS_{County} / HS_{State}) \times EF_{Adj} \times M$

= (\$35,474/\$4,000/mi x 15.2 acres/mi) * (187/1058) + (\$21,332/\$1,600/mi x 15.2 acres/mi) * (187/1058)

= 54 acres x 0.28ton/acre-month x 12 months

= 181.4 tons PM_{10}

Where EF_{Adj} is calculated as follows:

$$EF_{Adj} = 0.42 \text{ ton/acre-month} * (24/110.1 * 33/9)$$
$$= 0.28 \text{ ton/acre-month}$$

e. QA/QC

Missouri audited EPA's estimate by:

1. Data: Missouri added a sentence to the Source Category Description indicating the pollutants for which estimates were created using this method for the non-residential construction category.

   Missouri checked the first reference listed to verify 2008 funding spent by Missouri and verified it matches the information included in EPA's worksheets. Missouri also checked the building permits data from the Census Bureau, and verified that the 2008 number for building permits matched the data in EPA's worksheets. ***It is noted that 2010 building starts data is now available, and might be more representative of the activity in 2011 than the 2008 data.***

   Missouri notes that the North Carolina Department of Transportation (NCDOT) figures for $/mile include no reference citation. ***Missouri suggests adding a reference to these figures so that they can be verified.***

   Missouri also made efforts to verify the emission factor of 0.42 tons PM_{10}/acre-month, which was used for non-residential construction. Missouri was unable to locate the report cited in the references for this value; however, Missouri was able to find other State's that cite this same reference and used this same emission factor to develop PM emissions inventories for road construction activity. Also, the equation used to correct for silt content and soil moisture content was verified in the student manual of APTI course 419b. Missouri made no changes to EPA's NEI results for this source category based on the review of the data.

2. Math: Missouri reviewed the calculations and formulas in EPA's worksheets and found no mathematical or formula errors. Missouri made no changes to EPA's NEI results for this source category based on the review of the math.

3. Method: Missouri evaluated the reasonableness of the method. In general, the method of developing the activity data and emissions seems reasonable.

   It is noted that in comparing the 2008 NEI data to the 2011 NEI data for PM emissions from road construction, that there is a 312 percent increase. This is largely due to the increase in funding spent on road construction, as the funding spent in Missouri on road construction categories, as reported by the Federal Highway Administration (FHWA), increased by more than three-fold from 2006 to 2008, and therefore the emissions increase seems reasonable. It is noted that this is the 2011 NEI and the activity data is based on 2008 funding levels. While not preferred, there is no more recent year of funding levels available on FHWA's website, and therefore, it seems reasonable to use 2008 funding levels for the activity data calculations. ***However, if newer versions of this NEI are created and more recent funding levels become available on FHWA's***

website, then Missouri would suggest using the more recent data at that time, as it would likely be more representative of the 2011 road construction data.

It is noted that the NCDOT figures for converting funding spent to miles of road built was obtained in 2000. Due to inflation, it is possible that these figures are no longer representative of the cost per mile of road constructed. ***Missouri suggests that in future NEIs, if resources permit, the PPI index could be looked at for road construction or another similar category for both 2000 and the year for which the NEI is being calculated and through comparison of these two PPIs, an adjustment factor could be developed to account for inflation since 2000 and be applied to the $/mile figures.***

Additionally it is noted that Missouri counties have one of two different silt content ratios (52% or 28.8%). The method of picking one soil classification for each county is acceptable if the majority of the land in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all land in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.*** While Missouri has several suggestions for how the method used in the emission estimation for this source category could be improved upon, no changes were made to EPA's NEI results for this source category based on the review of the method.

f. References

1. 2008 Highway Spending : http://www.fhwa.dot.gov/policyinformation/statistics/2008/sf12a.cfm

2. 2008 Building Permits data from US Census "BPS01", http://www.census.gov/support/USACdataDownloads.html

3. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.

4. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.

8.10 Fugitive Dust: Construction Activities Non-residential

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection e contains Missouri's audit of EPA's estimate.

a. Source Category Description

Emissions from non-residential construction activity are a function of the acreage disturbed for non-residential construction. Fugitive dust emissions from non-residential construction were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this source category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2311020000	Industrial Processes	Construction: SIC 15 - 17	Heavy Construction	Total

b. Activity Data

Annual Value of Construction Put in Place in the U.S[1] has the 2011 National Value of Non-residential construction. The national value of non-residential construction put in place (in millions of dollars) was allocated to counties using county-level non-residential construction (NAICS Code 2362) employment data from 2009, which was obtained from *County Business Patterns*[2] *(CBP)*. Because some counties employment data was withheld due to privacy concerns, the following procedure was adopted:

1. State totals for the known county level employees was subtracted from the number of employees reported in the state level version of CBP. This results in the total number of withheld employees in the state.
2. A starting guess of the midpoint of the range code was used (so for instance in the 1-19 employees range, a guess of 10 employees would be used) and a state total of the withheld counties was computed.
3. A ratio of guessed employees (Step 2) to withheld employees (Step 1) was then used to adjust the county level guesses up or down so the state total of adjusted guesses should match state total of withheld employees (Step 1)

Once the number of employees was developed for each county, this number was divided by the total number of employees in the country to get a national allocation factor. The national allocation factor was

then multiplied by the 2011 National Value of Non-residential construction in order to estimate the value of non-residential construction in each county. Then in order to estimate the acres disturbed in each county, the value of non-residential construction in each county was multiplied by the adjusted 2011 ratio for acres per $\$10^6$, which was developed by the method below.

In 1999 a figure of 2 acres/$\$10^6$ was developed. The Bureau of Labor Statistics *Producer Price Index*[3] lists costs of the construction industry from 1999-2011.

2011 acres per $\$10^6$ = 1999 acres per $\$10^6$ x (1999 PPI / 2011 PPI)

=2 acres/$\$10^6$ * (132.9 / 229.3)

= 1.159 acres per $\$10^6$

c. Emission Factors

Initial PM_{10} emissions from construction of non-residential buildings are calculated using an emission factor of 0.19 tons/acre-month[4]. The duration of construction activity for non-residential construction is assumed to be 11 months. Since there are no condensable emissions, primary PM emissions are equal to filterable emissions. Once PM_{10}-PRI emissions are developed, $PM_{2.5}$-PRI emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10}-PRIemissions.

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM_{10} emissions from non-residential construction to develop the final emissions inventory.

To account for the soil moisture level, the PM_{10} emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite's PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.[4]

To account for the silt content, the PM_{10} emissions are weighted using average silt content for each county. A data base containing county-level dry silt values was complied. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.[5]

The equation for PM_{10} emissions corrected for soil moisture and silt content is:

$$Corrected\ E_{PM10} = Initial\ \mathrm{E}_{PM10} \times \frac{24}{PE} \times \frac{S}{9\%}$$

where: Corrected E_{PM10} = PM_{10} emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM_{10} adjustments have been made, $PM_{2.5}$ emissions are set to 10% of PM_{10}.

d. Example Calculation

$Emissions_{PM10} = N_{Spending}$ x $(Emp_{county} / Emp_{National})$ x Apd x EF_{Adj} x M

Where $N_{Spending}$ = National spending on non-residential construction (million dollars)

Emp_{county} = County level employment in non-residential construction

$Emp_{National}$ = National level employment in non-residential construction

Apd = Acres per million dollars (national data)

EF_{Adj} = Adjusted PM_{10} emission factor (ton/acre-month)

M = duration of construction activity (months)

As an example, in Grand Traverse County, Michigan, 2011 acres disturbed and PM_{10} emissions from non-residential construction are calculated as follows:

$$Emissions_{PM10} = 269{,}045 \times 10^6\ \$ \times (130/651{,}996) \times 1.159\ acres/10^6\$ \times EF_{Adj} \times M$$

$$= 62.2\ acres \times 0.059\ ton/acre\text{-}month \times 11\ months$$

$$= 40.4\ tons\ PM_{10}$$

Where EF_{Adj} is calculated as follows:

$$EF_{Adj} = 0.19\ ton/acre\text{-}month * (24/103.6 * 12/9)$$
$$= 0.059\ ton/acre\text{-}month$$

e. QA/QC

Missouri audited EPA's estimate by:

1. Data: Missouri added a sentence to the Source Category Description indicating the pollutants for which estimates were created using this method for the non-residential construction category. Missouri also added language to the activity data section in this document to more clearly explain the method of determining the number of acres disturbed by non-residential construction in each county.

   Missouri checked the first reference listed to verify the annual value of the non-residential construction put in place in the U.S. and compared this to the values included in EPA's worksheet. ***The values for non-residential construction included on reference 1 do not match the values in EPA's worksheet. It is possible that the data has been updated since EPA developed their worksheet. It is also possible that EPA added other categories that were not included in reference 1, such as public safety, sewer and waste disposal, water supply, conservation, and development and these categories make up the difference; however, if this is the case it should be noted both in this documentation and on the EPA worksheet. If the data has changed since the worksheet was developed or if this is an error, then the numbers***

currently included in reference 1 should be entered into the worksheet so that the current/accurate data is used for the NEI results. The updated numbers are input to the spreadsheet and used for calculations of the number of acres disturbed.

Missouri checked the second reference listed to verify the employment numbers used for Missouri. After researching the data, it was determined that the employment data from 2009, was used in the EPA worksheets. Missouri verified the total number of employees and spot checked several counties and no discrepancies between the data included on EPA's worksheet and the 2009 employment data were found. Missouri also added language to the activity data section of this document to explain that the employment data is for 2009. ***It is noted that 2010 employment data is now available, and for Missouri the total number of employees in the non-residential construction category has reduced by over 4,000 from 2009 to 2010, which is over 20 percent and would have a significant impact on the estimation of emissions if the 2010 data was used instead of 2009.***

This documentation states that in 1999 a figure of 2 acres/$\$10^6$ was developed. This documentation does not cite a reference for this figure. ***Missouri suggests citing a reference for this figure so that it can be verified by people reviewing the document.*** Further the EPA worksheet, which contains the values that were used to adjust this ratio from 1999 to 2011, uses PPI data from the Bureau of Labor Statistics for the non-residential maintenance and repair category. Missouri reviewed the PPI data from 1999 to 2011 for the non-residential maintenance and repair category and found no discrepancies between the values included in EPA's worksheet and the values reported by the Bureau of Labor Statistics.

Missouri also made efforts to verify the emission factor of 0.19 tons PM_{10}/acre-month, which was used for non-residential construction. Missouri was unable to locate the report cited in the references for this value; however, Missouri was able to find other State's that cite this same reference and used this same emission factor to develop PM emissions inventories for non-residential construction activity.

Also, the equation used to correct for silt content and soil moisture content was verified in the student manual of APTI course 419b.

2. Math: Missouri reviewed the calculations and formulas in EPA's worksheets and found no mathematical or formula errors. As stated above, several changes were made to the documentation that more clearly state the method of calculating the acres of soil disturbed; however Missouri made no changes to EPA's NEI results for this source category based on the review of the math.

3. Method: Missouri evaluated the reasonableness of the method. In general, the method of developing the activity data and emissions seems reasonable.

As noted above in the review of the data, the method of adjusting the ratio of acres/$10^6 from 1999 to 2011, uses PPI data from the non-residential maintenance and repair category. It is noted that PPI data from the for non-residential construction is not available for years prior to 2010, and therefore could not be used to adjust the 1999 figure; however, the category BNEW (new construction) is available from 1999 through 2011, and Missouri believes that the PPI from the new construction category might better characterize the PPI for the non-residential construction category than the non-residential maintenance and repair category. Logic would indicate that the materials and labor for new construction would more closely relate to non-residential construction than the materials and labor for the maintenance and repair of non-residential facilities. ***Missouri adjusted the 1999 – 2011 PPI data from the new construction category (BNEW) in order to adjust the 1999 figure to 2011 for acres/$10^6. The estimated acres disturbed per million dollars spent went from 1.15 to 1.30, and with the revised private construction put in place, the total national acreage disturbed went from 311,871 to 337,915 acres.***

Additionally it is noted that Missouri counties have one of two different silt content ratios (52% or 28.8%). The method of picking one soil classification for each county is acceptable if the majority of the cropland in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all cropland in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.*** While Missouri has several suggestions for how the method used in the emission estimation for this source category could be improved upon, no changes were made to EPA's NEI results for this source category based on the review of the method.

e. References

1. Annual Value of Construction Put in Place: http://www.census.gov/const/C30/priv2011.pdf

2. County Business Patterns: http://www.census.gov/econ/cbp/index.html

3. Bureau of Labor Statistics: http://data.bls.gov/pdq/SurveyOutputServlet Table BMNR

4. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.

5. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.

8.11 Fugitive Dust: Construction Activities Residential

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection e contains Missouri's audit of EPA's estimate.

a. Source Category Description

Emissions from residential construction activity are a function of the acreage disturbed and volume of soil excavated for residential construction. Residential construction activity is developed from data obtained from the U.S. Department of Commerce (DOC)'s Bureau of the Census. Fugitive dust emissions from residential construction were estimated for PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$-PRI, and $PM_{2.5}$-FIL. Since there are no PM-CON emissions for this category, PM_{10}-PRI emissions are equal to PM_{10}-FIL emissions and $PM_{2.5}$-PRI emissions are equal to $PM_{2.5}$-FIL.

For this source category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2311010000	Industrial Processes	Construction: SIC 15 - 17	General Building Construction	Total

b. Activity Data

There are two activity calculations performed for this SCC, acres of surface soil disturbed and volume of soil removed for basements.

b.1. Surface soil disturbed

The US Census Bureau has 2010 data for *Housing Starts - New Privately Owned Housing Units Started*[1] which provides regional level housing starts based on the groupings of the following unit types: 1 unit, 2-4 units, 5 or more units. A consultation with the Census Bureau in 2002 gave a breakdown estimated at 36.84 percent of the housing starts being for 2 unit structures, and 63.16 percent being for 3 and 4 unit structures. The 2-4 unit category was then divided into 2-units, and 3-4 units based on these percentages. To get the number of structures for each grouping, the 1 unit category was divided by 1, the 2 unit category was divided by 2, and the 3-4 unit category was divided by 3.5. The 5 or more unit category listed may be made up of more than one structure. *New Privately Owned Housing Units Authorized Unadjusted Units*[2] gives a conversion factor to determine the ratio of units to structures in the 5 or more unit category. For example if a county has one 40 unit apartment building, the ratio would be 40/1. If there are 5 different 8 unit buildings in the same project, the ratio would be 40/5. Structures started by category are then calculated at a regional level. The table *Annual Housing Units Authorized by Building Permit*[3] has 2010 building permit data at the county level. This data was used by comparing the building permit data by unit type at the county level to the regional level to determine the ratio of county building permits to regional building permits by unit type. This ratio was then applied to allocate the regional housing starts data to the county level by unit type. This results in county level housing starts by unit type. The following surface areas were assumed disturbed for each unit type:

Surface Soil disturbed per unit type

1-Unit	1/4 acre/structure
2-Unit	1/3 acre/structure
Apartment	1/2 acre/structure

The 3-4 unit category was considered to be an apartment. Multiplication of housing starts to soil removed results in number of acres disturbed for each unit category.

b.2. Basement soil removal

To calculate basement soil removal, 2010 *Characteristics of New Houses*[4] is used to estimate the percentage of 1 unit structures that have a basement (on the regional level). The county level estimate of number of 1 unit starts is multiplied by the percent of 1 unit houses in the region that have a basement to get the number of basements in a county. Basement volume is calculated by assuming a 2000 square foot house has a basement dug to a depth of 8 feet (making 16,000 ft^3 per basement). An additional 10% is added for peripheral dirt bringing the total to 17,600 ft^3 per basement.

c. Emission Factors

Initial PM_{10} emissions from construction of single family, two family, and apartments structures are calculated using the emission factors given in the table below. The duration of construction activity for houses is assumed to be 6 months and the duration of construction for apartments is assumed to be 12 months.

Emission Factors for Residential Construction[5]

Type of Structure	Emission Factor	Duration of Construction
Apartments	0.11 tons PM_{10}/acre-month	12 months
2-Unit Structures	0.032 tons PM_{10}/acre-month	6 months
1-Unit Structures w/o Basements	0.032 tons PM_{10}/acre-month	6 months
1-unit Structures with Basements	0.011 tons PM_{10}/acre-month	6 months
	0.059 tons PM_{10}/1000 cubic yards	

Regional variances in construction emissions are corrected using soil moisture level and silt content. These correction parameters are applied to initial PM_{10} emissions from residential construction to develop the final emissions inventory.

To account for the soil moisture level, the PM_{10} emissions are weighted using the 30-year average precipitation-evaporation (PE) values from Thornthwaite's PE Index. Average precipitation evaporation values for each State were estimated based on PE values for specific climatic divisions within a State.

To account for the silt content, the PM_{10} emissions are weighted using average silt content for each county. A data base containing county-level dry silt values was compiled. These values were derived by applying a correction factor developed by the California Air Resources Board to convert wet silt values to dry silt values.[6]

The equation for PM_{10} emissions corrected for soil moisture and silt content is:

$$Corrected\ E_{PM10} = Initial\ \mathrm{E}_{PM10} \times \frac{24}{PE} \times \frac{S}{9\%}$$

where: Corrected E_{PM10} = PM_{10} emissions corrected for soil moisture and silt content,

PE = precipitation-evaporation value for each State,

S = % dry silt content in soil for area being inventoried.

Once PM_{10} adjustments have been made, PM2.5-FIL emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10}-FIL emissions[7]. Primary PM emissions are equal to filterable emissions since there are no condensable emissions from residential construction.

d. Example Calculation

PM_{10} Emissions = $\sum(A_{unit} \times T_{construction} \times EF_{unit}) \times Adj_{PM}$

Where $A_{unit} = HS_{Unit} \times SM_{Unit}$

HS_{Unit} = Regional Housing Starts x (county building permits/Regional building permits)

SM_{Unit} = Area or volume of soil moved for the given unit type

$T_{Construction}$ = Construction time (in months) for given unit type

EF_{Unit} = Unadjusted emission factor for PM_{10} for the given unit type

Adj_{PM} = PM Adjustment factor

As an example, in Beaufort County, North Carolina, 2010 acres disturbed and PM_{10} emissions from 1-unit housing starts without a basement are calculated as follows:

A_{unit} = 247,000 x (211/232,280) x $0.907_{(\text{Fraction without basement})}$ * 0.25 acres/unit

= 203 units * 0.25 acres/unit = 50.9 acres

Adj_{PM} = (24/110.1) * (10/9) = 0.242

PM_{10} Emissions = (50.9 acres x 6 months x 0.032 tons PM_{10}/acre-month) x 0.242 = 2.37 tons PM_{10}

e. QA/QC

Missouri audited EPA's estimate by:

4. Data: Missouri added a sentence to the Source Category Description indicating the pollutants for which estimates were created using this method for the residential construction category. Missouri reviewed EPA's worksheets and the Activity data section of this document, and made several changes to the

language in section b.1, to more accurately describe the methods that were used to determine the amount of soil disturbed through residential construction in each county. Specifically, when referring to breaking down the 2-4 unit category, this document originally said that 1/3 were 2-unit structures and 2/3 were 3-unit or 4-unit structures based on 2002 Census Bureau data, Missouri inserted the actual percentages that EPA used in their worksheets in order to provide more clarity. Additionally, when referring to the method of determining the number of structures for apartment buildings, Missouri changed the order in which the ratio was stated for the amount of structures for a given number of units to more clearly state this method. Language was also added to more clearly state how the EPA's worksheets used the building permit data to convert regional level housing starts to county level housing starts. Finally, in keeping with the language used in section b.1, the title of first table was changed from soil "removed" to soil "disturbed".

Missouri also evaluated the values in in the first table. Missouri notes that there is no reference cited for the values in this table. The following website is the California Air Resources Board's CARB's method for determining fugitive dust emissions from building construction, updated 1997: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-7prev.pdf. Missouri notes that 1-unit structures in CARB;'s method range from 1/7 of an acre disturbed to 1/5 of an acre disturbed, both of which are less than the value in Table 1 of 1/4 of an acre disturbed per 1-unit structure. ***Missouri suggests that a source be cited that was used to obtain the values in this table so that the values can be verified.***

Similarly, the values in second table were evaluated by Missouri. Missouri was unable to locate the report cited in the references for the values in this table. However, CARB's method of determining these emissions cites the exact same source, and uses instead a value of 0.11 tons PM_{10} per acre-month for all building types. ***Missouri suggests that the values in the second table be verified.***

Also, the equation used to correct for silt content and soil moisture content was verified in the student manual of APTI course 419b. As noted above, Missouri has several suggestions for how the data used in this emission estimation method could be improved upon; however, no changes were made to EPA's NEI results for this source category. Only changes to this narrative documentation were made.

5. Math: Two counties were missing from the county soil disturbed worksheet (29085 Hickory County and 29223 Wayne County). The lookup tables in the emissions calculations for these two counties used the same county soil disturbed data as the counties with the next lowest County FIPS Code. This resulted in calculations for these two counties matching identically to the emissions calculations from Henry and Washington Counties, respectively. This is an obvious mistake; however, since the state doesn't have the county level building permit data and these two counties are not included on the CO2010A worksheet, this error cannot be corrected by the State. ***Missouri suggests that EPA find the building permit data for these two counties and adjust the values in the worksheets to correct this error.***

   Missouri manually verified the emission calculations in EPA's worksheet for numerous counties in Missouri. All of the manually calculated emission values agreed with the final values in EPA's worksheet, except for the two discrepancies listed above for Hickory and Wayne Counties. Further, Missouri evaluated the formulas in EPA's excel worksheet for this source category and found no errors in any of the formulas, but the lookup tables in the emissions calculations worksheet could be enhanced by using "FALSE" as the range_lookup argument because doing so would return an error for counties that are not included on the soil disturbed worksheet as opposed to using the data for the county with the next lowest FIPS. ***As stated above, several changes were made to the documentation that more clearly state the actual method of calculating the area of soil surface disturbed, and Missouri strongly suggests that EPA correct the errors for Hickory and Wayne Counties.*** However, Missouri was unable to make any changes to EPA's NEI results for this source category based on the review of the math.

6. Method: Missouri evaluated the reasonableness of the method. In general, the method of developing the activity data and emissions seems reasonable. However, the method of determining the number of structures included in the 5 or more unit structures and applying the same amount of acreage disturbed for each of such structures, regardless of the actual number of units in the structure seems like it could be improved upon. Logic indicates that structures with more units will inherently disturb more soil than structures with fewer units. ***Missouri would suggest obtaining an average number of units per structure by region or county for the 5 or more unit category and then apply a derived factor to this average in order to more accurately estimate the area disturbed for the 5 or more unit category.*** Additionally it is noted that Missouri counties have one of two different silt content ratios (52% or 28.8%). The method of picking one soil classification for each county is acceptable if the majority of the cropland in the county is that particular soil classification, but this may not always be the case. Although acceptable, it is also noted that it rarely would be the case that all cropland in a county is of the same soil classification, ***and for future NEIs if resources permit, Missouri suggests using weighted percentages for soil classifications to develop the silt content percentage for each county, as this would likely yield more accurate values.*** While Missouri has several suggestions for how the method used in the emission estimation for this source category could be improved upon, no changes were made to EPA's NEI results for this source category.

f. References

1. New Privately Owned Housing Units Started for 2010 (Not seasonally adjusted), available at: http://www.census.gov/const/startsua.pdf

2. Table 2au. New Privately Owned Housing Units Authorized - Unadjusted Units for Regions, Divisions, and States, Annual 2010, available at: http://www.census.gov/const/C40/Table2/tb2u2010.txt

3. Annual Housing Units Authorized by Building Permits CO2010A, purchased from US Department of Census

4. Type of Foundation in New One-Family Houses Completed, available at: http://www.census.gov/const/C25Ann/sftotalfoundation.pdf

5. Midwest Research Institute. Improvement of Specific Emission Factors (BACM Project No. 1). Prepared for South Coast Air Quality Management District. March 29, 1996.

6. Campbell, 1996: Campbell, S.G., D.R. Shimp, and S.R. Francis. *Spatial Distribution of PM-10 Emissions from Agricultural Tilling in the San Joaquin Valley*, pp. 119-127 in Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association, Reno, NV. 1996.

7. "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors," C. Cowherd, J. Donaldson and R. Hegarty, Midwest Research Institute; D. Ono, Great Basin UAPCD. http://www.epa.gov/ttn/chief/conference/ei15/session14/cowherd.pdf

8.12 Fugitive Dust: Mining and Quarrying

The Missouri DNR developed the following estimate of emission from this source category.

a. *Source Category Description*

Mining and quarrying activities produce particulate emissions due to the variety of processes used to extract the ore and associated overburden, including drilling and blasting, loading and unloading, and overburden replacement. Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal. Each of these mining operations has specific emission factors accounting for the different means by which the resources are extracted.

For this source category the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2325000000	Industrial Processes	Mining and Quarrying: SIC 14	All Processes	Total

b. *Emission Factors and Equations*

Metallic Ore Mining

The emissions factor for metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The TSP emission factors developed for copper ore mining are applied to all three activities with PM_{10}/TSP ratios of 0.35 for overburden removal, 0.81 for drilling and blasting, and 0.43 for loading and unloading operations.[1] The emissions factor equation for metallic ore mining is:

$$EF_{mo} = EF_o + (B \times EF_b) + EF_l + EF_d$$

where, EF_{mo} = metallic ore mining emissions factor (lbs/ton)

EF_o = PM_{10} open pit overburden removal emission factor for copper ore (lbs/ton)

B = fraction of total ore production that is obtained by blasting at metallic ore mines

EF_b = PM_{10} drilling/blasting emission factor for copper ore (lbs/ton)

EF_l = PM_{10} loading emission factor for copper ore (lbs/ton)

EF_d = PM_{10} truck dumping emission factor for copper ore (lbs/ton)

Applying the copper ore mining TSP emissions factors[2] and PM_{10}/TSP ratios yields the following metallic ore mining emissions factor:

$$EF_{mo} = 0.0003 + (0.57625 \times 0.0008) + 0.022 + 0.032 = 0.0548 \text{ lbs/ton}$$

Non-Metallic Ore Mining

The emissions factor for non-metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The emissions factor is based on western surface coal mining operations.

$$EF_{nmo} = EFv + (D \times EF_r) + EF_a + 0.5\ (EF_e + EF_t)$$

where, EF_{nmo} = non-metallic ore mining emissions factor (lbs/ton)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

D = fraction of total ore production that is obtained by blasting at non-metallic ore mines

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EFa = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EFe = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EFt = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal

mining operations (lbs/ton)

Applying the TSP emissions factors developed for western surface coal mining operations from AP-42[3] and a PM_{10}/TSP ratio of 0.4[4] yields the following non-metallic ore mining emissions factor:

$$EF_{nmo} = 0.225 + (0.61542 \times 0.00005) + 0.05 + 0.5\ (0.0035 + 0.033) = 0.293 \text{ lbs/ton}$$

Coal Mining

The emissions factor for coal mining includes overburden removal, drilling and blasting, loading and unloading and overburden replacement activities. The amount of overburden material handled is assumed to equal ten times the quantity of coal mined and coal unloading is assumed to split evenly between end-dump and bottom-dump operations. The emissions factor equation for coal mining is:

$$EF_c = (10 \times (EF_{to} + EF_{or} + EF_{dt})) + EF_v + EF_r + EF_a + (0.5 \times (EF_e + EF_t))$$

where, EF_c = coal mining emissions factor (lbs/ton)

EF_{to} = PM_{10} emission factor for truck loading overburden at western surface coal mining operations (lbs/ton of overburden)

EF_{or} = PM_{10} emission factor for overburden replacement at western surface coal mining operations (lbs/ton of overburden)

EF_{dt} = PM_{10} emission factors for truck unloading: bottom dump-overburden at western surface coal mining operations (lbs/ton of overburden)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EF_a = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EF_e = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EF_t = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

Applying the PM_{10} emissions factors developed for western surface coal mining operations[3] yields the following coal mining emissions factor:

$$EF_c = (10 \times (0.015 + 0.001 + 0.006)) + 0.225 + 0.00005 + 0.05 + (0.5 \times (0.0035 + 0.033)) = 0.513 \text{ lbs/ton}$$

PM-FIL emissions factors are assumed to be the same as PM-PRI emissions factors; however, in reality, there is a small amount of PM-CON emissions included in the PM-PRI emissions but insufficient data exists to tease out the PM-CON portion. In 2006, the EPA adopted new $PM_{2.5}/PM_{10}$ ratios for several fugitive dust categories and concluded that the $PM_{2.5}/PM_{10}$ ratios for fugitive dust categories should be in the range of 0.1 to 0.15.[5]

Consequently, a ratio of 0.125 was applied to the PM_{10} emissions factors to estimate $PM_{2.5}$ emissions factors for mining and quarrying. A summary of emissions factors is presented in the table below.

Summary of Emission Factors

Mining Type	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
Coal	PM_{10}-PRI	0.513	LB	TON
Coal	PM_{10}-FIL	0.513	LB	TON
Coal	$PM_{2.5}$-PRI	0.064	LB	TON
Coal	$PM_{2.5}$-FIL	0.064	LB	TON
Metallic	PM_{10}-PRI	0.0548	LB	TON
Metallic	PM_{10}-FIL	0.0548	LB	TON
Metallic	$PM_{2.5}$-PRI	0.0068	LB	TON
Metallic	$PM_{2.5}$-FIL	0.0068	LB	TON
Non-Metallic	PM_{10}-PRI	0.293	LB	TON
Non-Metallic	PM_{10}-FIL	0.293	LB	TON
Non-Metallic	$PM_{2.5}$-PRI	0.037	LB	TON
Non-Metallic	$PM_{2.5}$-FIL	0.037	LB	TON

c. *Activity*

Emissions were estimated by obtaining state-level metallic and non-metallic crude ore handled at surface mines from the U.S. Geologic Survey (USGS) [6] and mine specific coal production data for surface mines from the Energy Information Administration (EIA) [7]. Since some of the USGS metallic and non-metallic minerals waste data associated with ore production are withheld to avoid disclosing company proprietary data, an allocation procedure was developed to estimate the withheld data. For states with withheld waste data, the state fraction of national ore production was multiplied by the national undisclosed waste value to estimate the state withheld data. In addition, the USGS only reports metallic and non-metallic minerals production data separately at the national-level (e.g., the production data is combined at the state-level). To estimate metallic versus non-metallic ore production and associated waste at the state-level, the state-level total production and waste data were multiplied by the national metallic or non-metallic percentage of total production.

d. *Activity Allocation Procedure*

State-level metallic and non-metallic crude ore and associated waste handled was allocated to the county-level using employment. Specifically, state-level activity data was multiplied by the ratio of county- to state-level number of employees in the metallic and non-metallic mining industries (see table below for a list of NAICS codes).

NAICS Codes for Metallic and Non-Metallic Mining

NAICS Code	Description
2122	Metal Ore Mining
212210	Iron Ore Mining
21222	Gold Ore and Silver Ore Mining
212221	Gold Ore Mining
212222	Silver Ore Mining
21223	Copper, Nickel, Lead, and Zinc Mining
212231	Lead Ore and Zinc Ore Mining
212234	Copper Ore and Nickel Ore Mining
21229	Other Metal Ore Mining
212291	Uranium-Radium-Vanadium Ore Mining
212299	All Other Metal Ore Mining
2123	Nonmetallic Mineral Mining and Quarrying
21231	Stone Mining and Quarrying
212311	Dimension Stone Mining and Quarrying
212312	Crushed and Broken Limestone Mining and Quarrying
212313	Crushed and Broken Granite Mining and Quarrying
212319	Other Crushed and Broken Stone Mining and Quarrying
21232	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying
212321	Construction Sand and Gravel Mining
212322	Industrial Sand Mining
212324	Kaolin and Ball Clay Mining
212325	Clay and Ceramic and Refractory Minerals Mining
21239	Other Nonmetallic Mineral Mining and Quarrying
212391	Potash, Soda, and Borate Mineral Mining
212392	Phosphate Rock Mining
212393	Other Chemical and Fertilizer Mineral Mining
212399	All Other Nonmetallic Mineral Mining

Employment data was obtained from the U.S. Census Bureau's 2009 County Business Patterns (*CBP*).[8] Due to concerns with releasing confidential business information, the *CBP* does not release exact numbers for a given

NAICS code if there are enough data that individual businesses could be identified. Instead a series of range codes is used. To estimate withheld counties the following procedure was used for each NAICS code being computed.

1. County level data for counties with known employment were totaled by state.
2. #1 subtracted from the state total reported in state-level *CBP*.
3. Each of the withheld counties is assigned the midpoint of the range code (e.g., A:1-19 employees would be assigned 10).
4. These midpoints are then summed to the state level.
5. #2 is divided by #4 as an adjustment factor to the midpoints.
6. #5 is multiplied by #3 to get the adjusted county-level employment.

For example, take the 2006 *CBP* data for NAICS 31-33 (Manufacturing) in Maine provided in the table below.

2006 County Business Pattern for NAICS 31-33 in Maine

fipsstate	fipscty	naics	empflag	emp
23	001	31----		6774
23	003	31----		3124
23	005	31----		10333
23	007	31----		1786
23	009	31----		1954
23	011	31----		2535
23	013	31----		1418
23	015	31----	F	0
23	017	31----		2888
23	019	31----		4522
23	021	31----		948
23	023	31----	I	0
23	025	31----		4322
23	027	31----		1434
23	029	31----		1014
23	031	31----		9749

1. The total of employees not including counties 015 and 023 is 52801.
2. The state-level *CBP* reports 59322 employees for NAICS 31----. The difference is 6521.
3. County 015 is given a midpoint of 1750 (since range code F is 1000-2499) and County 023 is given a midpoint of 17500.
4. State total for these two counties is 19250.
5. 6521/19250 = 0.33875.
6. The adjusted employment for county 015 is 1750*0.33875 = 592.82. County 023 has an adjusted employment of 17500*0.33875 = 5928.18.

In the event that data at the state level is withheld, a similar procedure is first performed going from the U.S. level to the state level. For example, known state-level employees are subtracted from the U.S. total yielding the total withheld employees. Next the estimated midpoints of the withheld states are added together and compared (by developing a ratio) to the U.S. total withheld employees. The midpoints are then adjusted by the ratio to give an improved estimate of the state total.

e. *Controls*

No controls were accounted for in the emissions estimation.

f. *Emissions Equation and Sample Calculation*

Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal:

$$E = E_m + E_n + E_c$$

where, E = PM_{10} emissions from mining and quarrying operations

E_m = PM_{10} emissions from metallic ore mining operations

E_n = PM_{10} emissions from non-metallic ore mining

E_c = PM_{10} emissions from coal mining operations

Four specific activities are included in the emissions estimate for mining and quarrying operations: overburden removal, drilling and blasting, loading and unloading, and overburden replacement. Not included are the transfer and conveyance operations, crushing and screening operations, and storage since the dust emissions from these activities are assumed to be well controlled. Emissions for each activity are calculated using the following equation:

$$E = EF \times A$$

where, $E = PM_{10}$ emissions from operation (e.g., metallic ore, non-metallic ore, or coal mining; lbs)

EF = emissions factor associated with operation (lbs/ton)

A = ore handled in mining operation (tons)

As an example, in 2009 Autauga County, Alabama handled 456,346 tons of metallic ore and associated waste, 714,718 tons of non-metallic ore and associated waste, and 0 tons of coal. Mining and quarrying PM_{10}-PRI emissions for Autauga County are:

$$E_{PM10\text{-}PRI,\ Autauga\ County} = [(456{,}346 \times 0.0548) + (714{,}718 \times 0.293) + (0 \times 0.513)]/2000 = 117\ \text{tons}$$

The division by 2000 is to convert from pounds to tons.

g. *References*

1. United States Environmental Protection Agency. *Generalized Particle Size Distributions for Use in Preparing Size-Specific Particulate Emissions Inventories*, EPA-450/4-86-013, July 1986.

2. United States Environmental Protection Agency, *National Air Pollutant Emission Trends Procedure Document for 1900-1996*, EPA-454/R-98-008, May 1998.

3. United States Environmental Protection Agency, AP-42, Fifth Edition, Volume 1, Chapter 11: Mineral Products Industry, Section 11.9: Western Surface Coal Mining, available at http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s09.pdf (accessed November 2011).

4. United States Environmental Protection Agency, *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*, EPA-450/4-90-003, March 1990.

5. Midwest Research Institute, *Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors*, MRI Project No. 110397, November 2006, available at http://www.epa.gov/ttnchie1/ap42/ch13/bgdocs/b13s02.pdf (accessed December 2011).

6. United States Geologic Survey, "Minerals Yearbook 2009", http://minerals.usgs.gov/minerals/pubs/commodity/m&q/index.html#myb (accessed April 2012).

7. Energy Information Administration, "Production by Company and Mine - 2009", http://www.eia.gov/coal/data.cfm#production (accessed April 2012).

8. U.S. Census Bureau, 2009 County Business Patterns, available at http://www.census.gov/econ/cbp/download/index.htm (accessed April 2012)

8.13 Fugitive Dust: Mining and Quarrying Lead Ore

The Missouri DNR developed the following estimate of emissions from this source category.

a. Source Category Description

Lead ore mining and milling is the process by which lead ore deposits are extracted and processed for transport to primary lead smelting and refining. The USGS[1] demonstrates that six lead mines operate in Missouri, and their emissions are reported as part of the point or nonpoint data category for the National Emissions Inventory (NEI). The Air Emissions Reporting Rule[2] (AERR) §51.50 instructs states to submit point source data on the three-year cycle for those sources with potential to emit over specific pollutant thresholds. Two of the six mines in Missouri meet the point source threshold (see section C.). Detailed information on those two operations is submitted based on AERR requirements, including the list of emission generating equipment, control devices, and emission release points. Four of the mines, and their associated milling operations, do not meet the requirements to be submitted as point sources, so their emission estimates are provided as a county-total nonpoint category.

For this nonpoint source category, the following source classification code (SCC) was created specifically at the request of Missouri:

List of nonpoint SCC codes

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2325060000	Industrial Processes	Mining and Quarrying: SIC 10	Lead Ore Mining and Milling	Total

b. Estimation Method

Missouri chose between two methods to develop emissions for this category: use emission inventory data collected from specific, stationary mining and milling sites, or use surrogate mining activity data with emission assumptions.

The Emission Inventory Improvement Program[4] (EIIP) Volume 3, Chapter 1 describes area source (now known as nonpoint source) emission estimation methods states can choose from. To obtain the most accurate inventory, the most specific data collected and quality assured is preferable to surrogate activity data that is allocated to the geographic region of interest. For the lead mining and milling category, these facilities have reported emissions directly to the state of Missouri as described in section c. Using quality assured facility-reported data ensures that the inventory is developed in a bottom-up fashion, as opposed to a top-down method where activity data from a much larger geographic region is used to estimate emissions and allocated down to the county level.

c. Source Identification

The list of all lead mining and milling sites are listed in the corresponding tables below. The lists are extracted from emission inventory data collected for Missouri sources subject to 10 CSR 10-6.110[3], for Standard Industrial Classification (SIC) 1031 – Lead and Zinc Ores. These sources obtain operating permits under 10 CSR 10-6.065[3] based on their potential to emit. Nonpoint sources are those with Basic operating permits whose potential to emit do not meet the AERR point source requirements.

List of Nonpoint Lead Ore Mining and Milling Facilities

County	Plant Id	Plant Name	Site Name	SIC	Operating Permit
Reynolds	0004	DOE RUN COMPANY	SWEETWATER MINE/MILL	1031	Basic
Reynolds	0005	DOE RUN COMPANY-BRUSHY CREEK MINE/MILL	VIBURNUM (BRUSHY CREEK)	1031	Basic
Iron	0017	DOE RUN COMPANY	VIBURNUM DIVISION (CENTRAL)	1031	Basic
Iron	0023	DOE RUN COMPANY	CASTEEL MINE	1031	Basic
Iron	0031	K AND D CRUSHING	CASTEEL MINE	1031	Basic
Washington	0041	K AND D CRUSHING	29 MINE AREA	1031	Basic

List of Point Source Lead Ore Mining and Milling Facilities

County	Plant Id	Plant Name	Site Name	SIC	Operating Permit
Reynolds	0006	DOE RUN COMPANY	BUNKER (FLETCHER MINE)	1031	Part 70
Iron	0005	DOE RUN COMPANY	BUICK MILL	1031	Part 70

Additional searches were performed on Missouri databases to search for other mining or milling operations. Name searches for “lead”, “ore”, “milling”, “mining”, and other iterations returned various other facilities who were investigated, but their permit documents excluded lead ore as their primary activity. The archive of all Missouri permit documents was searched for the same terms, but returned only facilities in tables above. A search of any other facility reporting lead emissions provided another list to review, but their permit documents and SICs quickly eliminated them from consideration. The lists above comprehensively cover the lead ore mining and milling category.

d. External Data Source Comparison for Lead

EPA’s Toxics Release Inventory[5] (TRI) was consulted as an external database to compare lead emissions as reported to Missouri against those reported to EPA. Missouri collects emission inventory data from all permitted sources on the schedule outlined in 10 CSR 10-6.110, including the nonpoint sources with Basic operating permits. This

Lead Emission Comparison

County	Plant Id	Plant Name	Site Name	Missouri Inventory Lead Emissions (tons per year)	TRI Lead Emissions (tons per year)
Reynolds	0004	DOE RUN COMPANY	SWEETWATER MINE/MILL	0.29	1.45
Reynolds	0005	DOE RUN COMPANY-BRUSHY CREEK MINE/MILL	VIBURNUM (BRUSHY CREEK)	0.70	.99
Iron	0017	DOE RUN COMPANY	VIBURNUM DIVISION (CENTRAL)	0.18	0
Iron	0023	DOE RUN COMPANY	CASTEEL MINE	0.20	NA
Iron	0031	K AND D CRUSHING	CASTEEL MINE	0.20	NA
Washington	0041	K AND D CRUSHING	29 MINE AREA	0.0044	NA

e. Emissions

The emission reports from the nonpoint facilities listed include both PM and lead emissions. The point source SCC codes used in these reports are:

SCC	SCC Description
30501049	Wind Erosion: Exposed Areas
30502001	Primary Crushing
30502002	Secondary Crushing/Screening
30502006	Miscellaneous Operations: Screen/Convey/Handling
30502009	Blasting: General
30502010	Drilling
30502011	Hauling
30502031	Truck Unloading
30502032	Truck Loading: Conveyor
30502507	Storage Piles
30301012	Raw Material Storage Piles
30301013	Raw Material Transfer
30303009	Raw Material Handling and Transfer

The emissions to be reported in the nonpoint category List of Nonpoint Lead Ore Mining and Milling Facilities are summed in the Lead Emission Comparison Table so they can be allocated to the county level.

f. References

1. USGS Commodity Statistics and Information 2012 http://minerals.usgs.gov/minerals/pubs/commodity/lead/mcs-2012-lead.pdf
2. USEPA's Air Emissions Reporting Rule, published December 4, 2008. http://www.epa.gov/ttnchie1/aerr/
3. Missouri Code of State Regulations. http://www.sos.mo.gov/adrules/csr/current/10csr/10c10-6a.pdf

4. Emission Inventory Improvement Program, EIIP Technical Report Series 3- Area Sources 2001. http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html
5. USEPA's Toxics Release Inventory (TRI) 2011 TRI Data Explorer. http://www.epa.gov/TRI/

8.14 Fugitive Dust Paved Roads

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. ***Source Category Description***

Mining and quarrying activities produce particulate emissions due to the variety of processes used to extract the ore and associated overburden, including drilling and blasting, loading and unloading, and overburden replacement. Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal. Each of these mining operations has specific emission factors accounting for the different means by which the resources are extracted.

For this source category the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2325000000	Industrial Processes	Mining and Quarrying: SIC 14	All Processes	Total

b. ***Emission Factors and Equations***

Metallic Ore Mining

The emissions factor for metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The TSP emission factors developed for copper ore mining are applied to all three activities with PM_{10}/TSP ratios of 0.35 for overburden removal, 0.81 for drilling and blasting, and 0.43 for loading and unloading operations.[1] The emissions factor equation for metallic ore mining is:

$$EF_{mo} = EF_o + (B \times EF_b) + EF_l + EF_d$$

where, EF_{mo} = metallic ore mining emissions factor (lbs/ton)

EF_o = PM_{10} open pit overburden removal emission factor for copper ore (lbs/ton)

B = fraction of total ore production that is obtained by blasting at metallic ore mines

EF_b = PM_{10} drilling/blasting emission factor for copper ore (lbs/ton)

EF_l = PM_{10} loading emission factor for copper ore (lbs/ton)

EF_d = PM_{10} truck dumping emission factor for copper ore (lbs/ton)

Applying the copper ore mining TSP emissions factors[2] and PM_{10}/TSP ratios yields the following metallic ore mining emissions factor:

$$EF_{mo} = 0.0003 + (0.57625 \times 0.0008) + 0.022 + 0.032 = 0.0548 \text{ lbs/ton}$$

<u>Non-Metallic Ore Mining</u>

The emissions factor for non-metallic ore mining includes overburden removal, drilling and blasting, and loading and unloading activities. The emissions factor is based on western surface coal mining operations.

$$EF_{nmo} = EFv + (D \times EF_r) + EF_a + 0.5\,(EF_e + EF_t)$$

where, EF_{nmo} = non-metallic ore mining emissions factor (lbs/ton)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

D = fraction of total ore production that is obtained by blasting at non-metallic ore mines

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EFa = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EFe = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EFt = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

Applying the TSP emissions factors developed for western surface coal mining operations from AP-42[3] and a PM_{10}/TSP ratio of 0.4[4] yields the following non-metallic ore mining emissions factor:

$$EF_{nmo} = 0.225 + (0.61542 \times 0.00005) + 0.05 + 0.5\,(0.0035 + 0.033) = 0.293 \text{ lbs/ton}$$

Coal Mining

The emissions factor for coal mining includes overburden removal, drilling and blasting, loading and unloading and overburden replacement activities. The amount of overburden material handled is assumed to equal ten times the quantity of coal mined and coal unloading is assumed to split evenly between end-dump and bottom-dump operations. The emissions factor equation for coal mining is:

$$EF_c = (10 \times (EF_{to} + EF_{or} + EF_{dt})) + EF_v + EF_r + EF_a + (0.5 \times (EF_e + EF_t))$$

where, EF_c = coal mining emissions factor (lbs/ton)

EF_{to} = PM_{10} emission factor for truck loading overburden at western surface coal mining operations (lbs/ton of overburden)

EF_{or} = PM_{10} emission factor for overburden replacement at western surface coal mining operations (lbs/ton of overburden)

EF_{dt} = PM_{10} emission factors for truck unloading: bottom dump-overburden at western surface coal mining operations (lbs/ton of overburden)

EF_v = PM_{10} open pit overburden removal emission factor at western surface coal mining operations (lbs/ton)

EF_r = PM_{10} drilling/blasting emission factor at western surface coal mining operations (lbs/ton)

EF_a = PM_{10} loading emission factor at western surface coal mining operations (lbs/ton)

EF_e = PM_{10} truck unloading: end dump-coal emission factor at western surface coal mining operations (lbs/ton)

EF_t = PM_{10} truck unloading: bottom dump-coal emission factor at western surface coal mining operations (lbs/ton)

Applying the PM_{10} emissions factors developed for western surface coal mining operations[3] yields the following coal mining emissions factor:

$$EF_c = (10 \times (0.015 + 0.001 + 0.006)) + 0.225 + 0.00005 + 0.05 + (0.5 \times (0.0035 + 0.033)) = 0.513 \text{ lbs/ton}$$

PM-FIL emissions factors are assumed to be the same as PM-PRI emissions factors; however, in reality, there is a small amount of PM-CON emissions included in the PM-PRI emissions but insufficient data exists to tease out the PM-CON portion. In 2006, the EPA adopted new $PM_{2.5}/PM_{10}$ ratios for several fugitive dust categories and concluded that the $PM_{2.5}/PM_{10}$ ratios for fugitive dust categories should be in the range of 0.1 to 0.15.[5] Consequently, a ratio of 0.125 was applied to the PM_{10} emissions factors to estimate $PM_{2.5}$ emissions factors for mining and quarrying. A summary of emissions factors is presented in the table below.

Summary of Emission Factors

Mining Type	Pollutant Code	Factor Numeric Value	Factor Unit Numerator	Factor Unit Denominator
Coal	PM_{10}-PRI	0.513	LB	TON
Coal	PM_{10}-FIL	0.513	LB	TON
Coal	$PM_{2.5}$-PRI	0.064	LB	TON
Coal	$PM_{2.5}$-FIL	0.064	LB	TON
Metallic	PM_{10}-PRI	0.0548	LB	TON
Metallic	PM_{10}-FIL	0.0548	LB	TON
Metallic	$PM_{2.5}$-PRI	0.0068	LB	TON
Metallic	$PM_{2.5}$-FIL	0.0068	LB	TON
Non-Metallic	PM_{10}-PRI	0.293	LB	TON
Non-Metallic	PM_{10}-FIL	0.293	LB	TON
Non-Metallic	$PM_{2.5}$-PRI	0.037	LB	TON
Non-Metallic	$PM_{2.5}$-FIL	0.037	LB	TON

c. *Activity*

Emissions were estimated by obtaining state-level metallic and non-metallic crude ore handled at surface mines from the U.S. Geologic Survey (USGS) [6] and mine specific coal production data for surface mines from the Energy Information Administration (EIA) [7]. Since some of the USGS metallic and non-metallic minerals waste data associated with ore production are withheld to avoid disclosing company proprietary data, an allocation procedure was developed to estimate the withheld data. For states with withheld waste data, the state fraction of national ore production was multiplied by the national undisclosed waste value to estimate the state withheld data. In addition, the USGS only reports metallic and non-metallic minerals production data separately at the national-level (e.g., the production data is combined at the state-level). To estimate metallic versus non-metallic ore production and associated waste at the state-level, the state-level total production and waste data were multiplied by the national metallic or non-metallic percentage of total production.

d. ***Activity Allocation Procedure***

State-level metallic and non-metallic crude ore and associated waste handled was allocated to the county-level using employment. Specifically, state-level activity data was multiplied by the ratio of county- to state-level number of employees in the metallic and non-metallic mining industries (see table below for a list of NAICS codes).

NAICS Codes for Metallic and Non-Metallic Mining

NAICS Code	Description
2122	Metal Ore Mining
212210	Iron Ore Mining
21222	Gold Ore and Silver Ore Mining
212221	Gold Ore Mining
212222	Silver Ore Mining
21223	Copper, Nickel, Lead, and Zinc Mining
212231	Lead Ore and Zinc Ore Mining
212234	Copper Ore and Nickel Ore Mining
21229	Other Metal Ore Mining
212291	Uranium-Radium-Vanadium Ore Mining
212299	All Other Metal Ore Mining
2123	Nonmetallic Mineral Mining and Quarrying
21231	Stone Mining and Quarrying
212311	Dimension Stone Mining and Quarrying
212312	Crushed and Broken Limestone Mining and Quarrying
212313	Crushed and Broken Granite Mining and Quarrying
212319	Other Crushed and Broken Stone Mining and Quarrying
21232	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying
212321	Construction Sand and Gravel Mining
212322	Industrial Sand Mining
212324	Kaolin and Ball Clay Mining
212325	Clay and Ceramic and Refractory Minerals Mining
21239	Other Nonmetallic Mineral Mining and Quarrying
212391	Potash, Soda, and Borate Mineral Mining
212392	Phosphate Rock Mining
212393	Other Chemical and Fertilizer Mineral Mining
212399	All Other Nonmetallic Mineral Mining

Employment data was obtained from the U.S. Census Bureau's 2009 County Business Patterns (*CBP*).[8] Due to concerns with releasing confidential business information, the *CBP* does not release exact numbers for a given NAICS code if there are enough data that individual businesses could be identified. Instead a series of range codes is used. To estimate withheld counties the following procedure was used for each NAICS code being computed.

7. County level data for counties with known employment were totaled by state.
8. #1 subtracted from the state total reported in state-level *CBP*.
9. Each of the withheld counties is assigned the midpoint of the range code (e.g., A:1-19 employees would be assigned 10).
10. These midpoints are then summed to the state level.
11. #2 is divided by #4 as an adjustment factor to the midpoints.
12. #5 is multiplied by #3 to get the adjusted county-level employment.

For example, take the 2006 *CBP* data for NAICS 31-33 (Manufacturing) in Maine provided in the table below.

2006 County Business Pattern for NAICS 31-33 in Maine

fipsstate	fipscty	naics	empflag	emp
23	001	31----		6774
23	003	31----		3124
23	005	31----		10333
23	007	31----		1786
23	009	31----		1954
23	011	31----		2535
23	013	31----		1418
23	015	31----	F	0
23	017	31----		2888
23	019	31----		4522
23	021	31----		948
23	023	31----	I	0
23	025	31----		4322
23	027	31----		1434

fipsstate	fipscty	naics	empflag	emp
23	029	31----		1014
23	031	31----		9749

7. The total of employees not including counties 015 and 023 is 52801.
8. The state-level *CBP* reports 59322 employees for NAICS 31----. The difference is 6521.
9. County 015 is given a midpoint of 1750 (since range code F is 1000-2499) and County 023 is given a midpoint of 17500.
10. State total for these two counties is 19250.
11. 6521/19250 = 0.33875.
12. The adjusted employment for county 015 is 1750*0.33875 = 592.82. County 023 has an adjusted employment of 17500*0.33875 = 5928.18.

In the event that data at the state level is withheld, a similar procedure is first performed going from the U.S. level to the state level. For example, known state-level employees are subtracted from the U.S. total yielding the total withheld employees. Next the estimated midpoints of the withheld states are added together and compared (by developing a ratio) to the U.S. total withheld employees. The midpoints are then adjusted by the ratio to give an improved estimate of the state total.

e. *Controls*

No controls were accounted for in the emissions estimation.

f. *Emissions Equation and Sample Calculation*

Fugitive dust emissions for mining and quarrying operations are the sum of emissions from the mining of metallic and nonmetallic ores and coal:

$$E = E_m + E_n + E_c$$

where, $E = PM_{10}$ emissions from mining and quarrying operations

$E_m = PM_{10}$ emissions from metallic ore mining operations

$E_n = PM_{10}$ emissions from non-metallic ore mining

$E_c = PM_{10}$ emissions from coal mining operations

Four specific activities are included in the emissions estimate for mining and quarrying operations: overburden removal, drilling and blasting, loading and unloading, and overburden replacement. Not included are the transfer and conveyance operations, crushing and screening operations, and storage since the dust emissions from these activities are assumed to be well controlled. Emissions for each activity are calculated using the following equation:

$$E = EF \times A$$

where, E = PM_{10} emissions from operation (e.g., metallic ore, non-metallic ore, or coal mining; lbs)

EF = emissions factor associated with operation (lbs/ton)

A = ore handled in mining operation (tons)

As an example, in 2009 Autauga County, Alabama handled 456,346 tons of metallic ore and associated waste, 714,718 tons of non-metallic ore and associated waste, and 0 tons of coal. Mining and quarrying PM_{10}-PRI emissions for Autauga County are:

$$E_{\text{PM10-PRI, Autauga County}} = [(456{,}346 \times 0.0548) + (714{,}718 \times 0.293) + (0 \times 0.513)]/2000 = 117 \text{ tons}$$

The division by 2000 is to convert from pounds to tons.

g. *References*

1. United States Environmental Protection Agency. *Generalized Particle Size Distributions for Use in Preparing Size-Specific Particulate Emissions Inventories*, EPA-450/4-86-013, July 1986.

2. United States Environmental Protection Agency, *National Air Pollutant Emission Trends Procedure Document for 1900-1996*, EPA-454/R-98-008, May 1998.

3. United States Environmental Protection Agency, AP-42, Fifth Edition, Volume 1, Chapter 11: Mineral Products Industry, Section 11.9: Western Surface Coal Mining, available at http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s09.pdf (accessed November 2011).

4. United States Environmental Protection Agency, *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*, EPA-450/4-90-003, March 1990.

5. Midwest Research Institute, *Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors*, MRI Project No. 110397, November 2006, available at http://www.epa.gov/ttnchie1/ap42/ch13/bgdocs/b13s02.pdf (accessed December 2011).

6. United States Geologic Survey, "Minerals Yearbook 2009", http://minerals.usgs.gov/minerals/pubs/commodity/m&q/index.html#myb (accessed April 2012).

7. Energy Information Administration, "Production by Company and Mine - 2009", http://www.eia.gov/coal/data.cfm#production (accessed April 2012).

8. U.S. Census Bureau, 2009 County Business Patterns, available at http://www.census.gov/econ/cbp/download/index.htm (accessed April 2012)

8.15 Fugitive Dust: Unpaved Roads

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.16 Asphalt Plants

The Missouri DNR developed the following estimate of emissions from this source category.

a. Source Category Description

Asphalt plants operate throughout the state to provide materials for public and private road paving. The Air Emissions Reporting Rule[2] (AERR) §51.50 instructs states to submit point source data on the three-year cycle for those sources with potential to emit over specific pollutant thresholds. Of the 110 asphalt plants in Missouri, 12 are submitted as point sources. Detailed information on those 12 operations is submitted based on AERR requirements, including the list of emission generating equipment, control devices, and emission release points. 98 of the facilities, and their associated asphalt operations, do not meet the requirements to be submitted as point sources, so their emission estimates are provided as a county-total nonpoint category.

For this nonpoint source category, the following source classification code (SCC) will report nonpoint asphalt plant emissions:

List of nonpoint SCC codes

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2306000000	Industrial Processes	Petroleum Refining: SIC 29	All Processes	Total

b. Estimation Method

Missouri chose between two methods to develop emissions for this category: use emission inventory data collected from specific, stationary asphalt plants, or use surrogate activity data with emission assumptions.

The Emission Inventory Improvement Program[4] (EIIP) Volume 3, Chapter 1 describes area source (now known as nonpoint source) emission estimation methods states can choose from. To obtain the most accurate inventory, the most specific data collected and quality assured is preferable to surrogate activity data that is allocated to the geographic region of interest. For the asphalt plant category, these facilities have reported emissions directly to the state of Missouri as described in section c. Using quality assured facility-reported data ensures that the inventory is developed in a bottom-up fashion, as opposed to a top-down method where activity data from a much larger geographic region is used to estimate emissions and allocated down to the county level.

c. Source Identification

The names of all asphalt sites are listed in the corresponding tables above. The lists are extracted from emission inventory data collected for Missouri sources subject to 10 CSR 10-6.110[3]. Any facility reporting an SCC for asphalt plant , is included in these lists. Nonpoint sources are those with Basic (BAS) or Intermediate (INT) operating permits whose potential to emit do not meet the AERR point source requirements. Other facilities with no operating permits (NOP) are included because they have voluntarily taken limits via a construction permit. Facilities with a construction permit are required to submit emission reports to the state.

Missouri had 33 asphalt plants that reported their 2011 Missouri emissions under a portable number. They can move their equipment to different counties in the state (and also out of state). The asphalt emissions from the portable equipment are approximately a third of the total nonpoint emissions for Missouri. This is a significant amount and it was decided to include these emissions in the inventory. These emissions are proportioned to the counties that reported asphalt emissions. The distribution of the portable emissions is weighted based upon the amount of reported nonpoint emissions from the stationary sources in each county.

List of Nonpoint Asphalt Facilities

County	Plant ID	Plant Name	Site Name

County	Plant ID	Plant Name	Site Name
29001	0002	W. L. MILLER COMPANY	KIRKSVILLE PLANT
29009	0042	HUTCHENS CONSTRUCTION COMPANY	PURDY PLANT
29019	0065	APAC MISSOURI	PLANT 03
29023	0021	DELTA ASPHALT INC	POPLAR BLUFF PLANT
29027	0054	CHRISTENSEN ASPHALT	KINGDOM CITY
29027	P028	APAC MISSOURI	MILLERSBURG - PLANT 15
29029	0016	APAC MISSOURI	PLANT 8 - LINN CREEK
29037	0032	APAC KANSAS INC	HARRISONVILLE ASPHALT PLANT
29043	0005	LEO JOURNAGAN CONSTRUCTION CO	OZARK
29047	0182	IDEKER INC	MOSBY
29047	2219	SUPERIOR ASPHALT COMPANY INC	KANSAS CITY
29047	2221	CARTER-WATERS CORPORATION	SKILES FACILITY
29051	0040	ASPHALT PRODUCTS INC	JEFFERSON CITY PLANT
29055	0048	ASPHALT PRODUCTS INC	CRAWFORD LIME
29055	P027	N. B. WEST CONTRACTING CO INC	BOURBON
29071	0202	MID MISSOURI ASPHALT LLC	ST. CLAIR
29071	P123	N. B. WEST CONTRACTING CO INC	PACIFIC PLANT
29077	0131	APAC MISSOURI	WILLARD PLANT 2
29077	0259	BLEVINS ASPHALT CONSTRUCTION CO INC	HWY 60
29079	0014	TRENTON STREET DEPARTMENT	TRENTON STREET DEPARTMENT
29083	0011	APAC MO, INC	TIGHTWAD (LEESVILLE) QUARRY
29091	0077	FOSTER REDI-MIX	PLANT #1 WEST PLAINS
29091	0083	PACE CONSTRUCTION	DOSS & HARPER QUARRY
29095	0003	J. M. FAHEY CONSTRUCTION COMPANY	TRACY PLANT
29095	0061	APAC KANSAS	SUGAR CREEK PLANT
29095	0089	SUPERIOR ASPHALT INC	LEE'S SUMMIT PLANT
29095	0176	SUPERIOR BOWEN ASPHALT CO LLC	MANCHESTER ROAD SITE
29095	0192	SUPERIOR BOWEN ASPHALT COMPANY LLC	LEE'S SUMMIT (PLANT 3)
29095	2052	SUPERIOR ASPHALT PORTABLE PLANT	KANSAS CITY
29095	2440	HOT MIX MATERIALS INC	85TH ST
29097	0017	CARTHAGE CRUSHED LIMESTONE	CARTHAGE CRUSHED LIMESTONE
29097	0139	SWIFT CONSTRUCTION COMPANY INC	JOPLIN PLANT
29097	0146	BLEVINS ASPHALT CONSTRUCTION CO INC	CARTHAGE - CIVIL WAR ROAD
29099	0007	FRED WEBER INC	FESTUS ASPHALT PLANT
29099	0098	FRED WEBER INC	TRAUTMAN ASPHALT PLANT
29099	0146	PACE CONSTRUCTION CO	ANTONIA ASPHALT PLANT
29099	P094	N. B. WEST CONTRACTING CO INC	HOUSE SPRINGS ASPHALT
29101	0031	HILTY QUARRIES INC	WARRENSBURG II QUARRY
29105	0027	WILLARD QUARRIES INC	SLEEPER QUARRY
29113	0032	G & M CONCRETE AND ASPHALT CO INC	TROY PLANT
29113	0069	PACE CONSTRUCTION CO	CENTRAL-MOSCOW MILLS

County	Plant ID	Plant Name	Site Name
29119	0024	HUTCHENS CONSTRUCTION COMPANY	BELLA VISTA FACILITY
29139	0025	PACE CONSTRUCTION CO	DANVILLE PLANT
29143	0003	DELTA ASPHALT INC	NEW MADRID PLANT
29151	0037	HIGGINS QUARRY LLC	MUENKS QUARRY SITE
29157	0032	LAFARGE WEST INC	PERRYVILLE ASPHALT
29159	0002	APAC-MISSOURI	SEDALIA QUARRY & ASPHALT
29159	0038	MID-MISSOURI LIMESTONE INC	HOUSTONIA QUARRY
29161	0009	ASPHALT PRODUCTS INC	ROLLA PLANT
29161	0034	MELROSE QUARRY AND ASPHALT LLC	ROLLA
29165	2402	SUPERIOR BOWEN ASPHALT CO LLC	144TH (PLANT 2)
29165	2422	SUPERIOR BOWEN ASPHALT CO LLC	KCI
29169	0027	WILLARD QUARRIES COMPANY INC	ST. ROBERT QUARRY
29173	0019	C. B. ASPHALT INC	HUNTINGTON PLANT (PLANT #4)
29175	0049	APAC MISSOURI	PLANT #5
29183	0096	PACE CONSTRUCTION CO	ST. CHARLES PLANT
29187	0001	LEAD BELT MATERIALS CO INC	PARK HILLS
29187	0072	BASE ROCK MINERALS INC	BONNE TERRE PLANT
29189	0040	PACE CONSTRUCTION CO.	JEFFERSON BARRICKS PLANT
29189	0201	PACE CONSTRUCTION CO	ANTIRE QUARRY PLANT
29189	1521	PACE CONSTRUCTION CO	FLORISSANT
29189	1523	MISSOURI VALLEY ASPHALT LLC	BRIDGETON
29195	0005	APAC MISSOURI	MARSHALL PLANT
29207	0001	ASA ASPHALT INC	ADVANCE
29213	0003	TABLE ROCK ASPHALT CONSTR CO INC	HWY 248 QUARRY
29777	0016	LEO JOURNAGAN CONSTRUCTION CO	LEO JOURNAGAN CONSTRUCTION CO
29777	0059	LEO JOURNAGAN CONSTRUCTION CO	LEO JOURNAGAN CONSTRUCTION CO
29777	0061	APAC MISSOURI	APAC MISSOURI
29777	0093	APAC MISSOURI	PORTABLE PLANT #403
29777	0150	APAC MISSOURI	APAC MISSOURI
29777	0157	APAC MISSOURI	MASTERS JACKSON/SPRINGFIELD DIV. PORT #2
29777	0232	C. B. ASPHALT INC	PLANT #6
29777	0269	C. B. ASPHALT INC	PLANT #7
29777	0310	DELTA ASPHALT INC	CEDAR RAPIDS PORTABLE
29777	0352	NORRIS ASPHALT PAVING CO	NORRIS ASPHALT PAVING CO
29777	0361	FRED WEBER INC	FRED WEBER INC
29777	0363	W. L. MILLER CO	W. L. MILLER CO
29777	0396	APAC MISSOURI	CMI-ASPHALT
29777	0414	APAC MISSOURI	APAC MISSOURI
29777	0439	APAC MISSOURI	APAC-CENTRAL
29777	0441	C. B. ASPHALT INC	C. B. ASPHALT INC

County	Plant ID	Plant Name	Site Name
29777	0447	HERZOG CONTRACTING	HERZOG CONTRACTING
29777	0501	PACE CONSTRUCTION COMPANY	PACE CONSTRUCTION COMPANY
29777	0518	FRED WEBER INC	PORTABLE CMI #1
29777	0520	C. B. ASPHALT INC	PLANT # 9
29777	0521	HILTY QUARRIES INC	HILTY QUARRIES INC
29777	0525	LEO JOURNAGAN CONSTRUCTION CO	LEO JOURNAGAN CONSTRUCTION CO
29777	0546	NORRIS ASPHALT PAVING CO	PLANT 500
29777	0547	LAKE ASPHALT PAVING AND CONSTRUCTION	LAKE ASPHALT PAVING AND CONSTRUCTION
29777	0549	LEO JOURNAGAN CONSTRUCTION CO	10-009
29777	0552	APAC-SHEARS	APAC-SHEARS
29777	0562	IDEKER INC	IDEKER INC
29777	0564	PACE CONSTRUCTION CO	PACE CONSTRUCTION CO
29777	0581	APAC MISSOURI	APAC MISSOURI
29777	0657	A.E. SIMPSON CONSTRUCTION	PORTABLE ASPHALT
29777	0658	MAGRUDER PAVING LLC	PORTABLE ASPHALT
29777	0661	FRED WEBER INC	PORTABLE CMI #2
29777	0667	MAGRUDER PAVING	MAGRUDER PAVING

List of Point Source Asphalt Facilities

County	Plant ID	Plant Name	Site Name
29003	P011	KELLER CONSTRUCTION COMPANY	ST. JOSEPH
29031	0002	DELTA ASPHALT INC	CAPE GIRARDEAU
29095	0037	VANCE BROTHERS INC	BRIGHTON
29095	0064	VANCE BROTHERS INC	CHELSEA
29183	0004	FRED WEBER INC	O'FALLON ASPHALT PLANT
29187	0054	LEAD BELT MATERIALS CO INC	BONNE TERRE
29189	0111	MISSOURI ASPHALT PRODUCTS, LLC	WEST LAKE QUARRY & MATERIAL CO
29189	1226	SIMPSON CONSTRUCTION MATERIALS LLC	VALLEY PARK
29189	1248	FRED WEBER INC. - SOUTH ASPHALT (BATCH)	SOUTH ASPHALT
29189	1249	FRED WEBER INC - NORTH ASPHALT H AND B	NORTH ASPHALT, H&B
29189	1250	FRED WEBER INC. - NORTH ASPHALT B-G	NORTH ASPHALT, B-G
29510	0047	FRED WEBER INC	ASPHALT PLANT

d. Controls and Emission Factors

Almost all controls at a typical Missouri asphalt plant are for PM emissions. These controls are for haul roads and storage piles which are watered to keep the dust down.

The source of emission factors for the asphalt operations is almost exclusively from AP-42or FIRE. Haul road and storage pile worksheets are also used to determine emission factors. Formulas in these worksheets are pulled from AP-42.

e. Emissions

The emission reports from the nonpoint facilities listed include the pollutants in the table below. HAPs are not included except for Lead which Missouri collects from all sources. HAPs, when they are reported, are usually reported as a sum total and not broken out into specific pollutants. None of the 98 non-point sources on our list reported NH_3.

List of Pollutants

Pollutant Name
PM_{10}-PRI
$PM_{2.5}$-PRI
SO_2
NO_X
VOC
CO
Lead

List of Asphalt SCCs and Description

SCC	Description Level 1	Description Level 2	Description Level 3	Description Level 4
30500201	Industrial Processes	Mineral Products	Asphalt Concrete	Rotary Dryer: Conventional Plant (see 3-05-002-50 to -53 for subtypes)
30500202	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Hot Elevs, Screens, Bins&Mixer (also see -45 thru -47
30500203	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Piles
30500204	Industrial Processes	Mineral Products	Asphalt Concrete	Cold Aggregate Handling
30500205	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Dryer: Drum Mix Plant (see 3-05-002-55 thru -63 for subtypes)
30500206	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Natural Gas
30500207	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Residual Oil
30500208	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Distillate Oil
30500209	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: LPG
30500211	Industrial Processes	Mineral Products	Asphalt Concrete	Rotary Dryer Conventional Plant with Cyclone ** use 3-05-002-01 w/CTL
30500212	Industrial Processes	Mineral Products	Asphalt Concrete	Heated Asphalt Storage Tanks
30500213	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Silo
30500214	Industrial Processes	Mineral Products	Asphalt Concrete	Truck Load-out
30500216	Industrial Processes	Mineral Products	Asphalt Concrete	Cold Aggregate Feed Bins
30500217	Industrial Processes	Mineral Products	Asphalt Concrete	Cold Aggregate Conveyors and Elevators
30500231	Industrial Processes	Mineral Products	Asphalt Concrete	Hot Bins and Screens: Continuous Process
30500240	Industrial Processes	Mineral Products	Asphalt Concrete	Mixers: Batch Process (also see -45 thru -47 for combos w/scr,bins
30500245	Industrial	Mineral	Asphalt	Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer & NG Rot Dryer

SCC	Description Level 1	Description Level 2	Description Level 3	Description Level 4
	Processes	Products	Concrete	
30500246	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Hot Elevators, Screens, Bins, Mixer& #2 Oil Rot Dryer
30500247	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Hot Elevs, Scrns, Bins, Mixer& Waste/Drain/#6 Oil Rot
30500251	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Rotary Dryer, Natural Gas-Fired (also see -45)
30500252	Industrial Processes	Mineral Products	Asphalt Concrete	Batch Mix Plant: Rotary Dryer, Oil-Fired (also see -46)
30500255	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas-Fired
30500257	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, Natural Gas, Counterflow
30500258	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired
30500259	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Parallel Flow
30500260	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer / Mixer, #2 Oil-Fired, Counterflow
30500261	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Plant: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil-Fired
30500263	Industrial Processes	Mineral Products	Asphalt Concrete	Drum Mix Pl: Rotary Drum Dryer/Mixer, Waste/Drain/#6 Oil, Counterflow
30500290	Industrial Processes	Mineral Products	Asphalt Concrete	Haul Roads: General
30500298	Industrial Processes	Mineral Products	Asphalt Concrete	Other Not Classified
30500299	Industrial Processes	Mineral Products	Asphalt Concrete	See Comment **
30505005	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Storage (Prior to Blowing)
30505022	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Heater: Distillate Oil

The emissions to be reported in the nonpoint category for facilities List of Nonpoint Asphalt Facilities are summed to the county level in the table below.

Nonpoint County Total Emissions for Asphalt Processes (tons per year)

StateFIPs	County	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NO_X	VOC	CO	Lead
29001	ADAIR	1.13	0.60	0.30	0.36	0.17	1.05	
29009	BARRY	1.62	0.41	1.10	2.15	0.54	1.95	
29019	BOONE	5.04	0.40	0.11	5.34	2.91	11.25	
29023	BUTLER	8.59	1.98	3.46	4.87	3.44	9.66	0.0017
29027	CALLAWAY	6.86	1.24	9.77	13.55	5.62	11.96	
29037	CASS	6.23	0.46	3.00	4.79	3.73	2.85	

StateFIPs	County	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NO_X	VOC	CO	Lead
29043	CHRISTIAN	2.39	0.04	1.01	6.60	7.62	29.43	
29047	CLAY	19.57	0.59	1.05	8.33	9.31	30.64	
29051	COLE	1.55	0.08	4.93	4.01	5.69	8.56	
29055	CRAWFORD	10.76		1.70	7.79	4.25	7.64	0.0001
29071	FRANKLIN	4.17	0.20	7.24	5.58	2.32	9.86	0.0003
29077	GREENE	9.96	0.68	0.43	13.62	8.47	32.73	0.0001
29079	GRUNDY	2.27	0.17	0.11	0.58	0.26	0.29	
29083	HENRY	5.03		2.44	0.95	0.61	0.79	
29091	HOWELL	6.66	0.00	3.66	3.49	2.39	0.56	
29095	JACKSON	30.71	1.14	8.27	26.59	27.86	83.08	
29097	JASPER	24.42	0.95	0.69	11.45	7.47	21.02	
29099	JEFFERSON	19.76	0.00	10.83	2.15	0.53	4.64	
29101	JOHNSON	0.97		12.59	2.63	1.02	4.10	
29105	LACLEDE	3.26	0.13	0.57	2.43	1.32	5.12	0.0009
29113	LINCOLN	3.76		7.86	10.13	6.88	11.72	0.0001
29119	MCDONALD	0.91		2.42	1.96	1.07	4.13	0.0007
29139	MONTGOMERY	2.96		0.03	0.24	0.15	0.15	
29143	NEW MADRID	0.79		0.05	0.49	0.15	7.03	
29151	OSAGE	1.33		3.14	0.96	0.43	1.67	
29157	PERRY	4.29	0.01	1.12	1.28	0.67	0.55	
29159	PETTIS	8.27	0.62	5.36	6.10	1.16	18.25	
29161	PHELPS	6.03	0.72	0.51	1.75	2.03	15.80	
29165	PLATTE	5.99		0.97	7.63	8.55	28.16	
29169	PULASKI	12.05	0.43	0.67	4.16	5.43	17.66	0.0003
29173	RALLS	8.73		3.88	10.05	1.50	2.28	
29175	RANDOLPH	2.27		0.82	2.33	1.26	4.86	
29183	ST. CHARLES	15.35		0.52	2.22	0.72	5.59	
29187	ST. FRANCOIS	9.88	0.28	3.61	5.45	1.57	19.55	0.0003
29189	ST. LOUIS CO.	8.07		25.33	19.21	8.75	54.26	
29195	SALINE	0.60	0.14	0.11	5.16	2.81	10.87	
29207	STODDARD	2.49	0.42	5.37	6.25	2.55	18.57	
29213	TANEY	1.58		4.19	1.44	0.42	0.71	
Total		266.30	11.68	139.21	214.06	141.63	498.97	0.0045

e. QA/QC

Quality assurance and quality checks were performed on the 2011 Emission Inventory Questionnaires as they were submitted. Any suspected faulty data was critically inspected by inventory staff and corrected as needed with the cooperation of the facilities. Other quality checks of the inventories were done on the data by staff throughout the year and for previous reporting years.

8.17 Gas Stations: Stage II

EPA created the national estimate for this category. As of February 28, 2014, there is no documentation provided by EPA for the development of this inventory. The county-total emission values were reviewed by Missouri and accepted.

8.18 Gasoline Distribution: Stage I

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Stage I gasoline distribution includes the following gasoline emission points: 1) bulk terminals; 2) pipeline facilities; 3) bulk plants; 4) tank trucks; and 5) service stations. Emissions from Stage I gasoline distribution occur as gasoline vapors are released into the atmosphere. These Stage I processes are subject to EPA's maximum available control technology (MACT) standards for gasoline distribution.[1]

Emissions from gasoline distribution at bulk terminals and bulk plants take place when gasoline is loaded into a storage tank or tank truck, from working losses (for fixed roof tanks), and from working losses and roof seals (for floating roof tanks). Working losses consist of both breathing and emptying losses. Breathing losses are the expulsion of vapor from a tank vapor space that has expanded or contracted because of daily changes in temperature and barometric pressure; these emissions occur in the absence of any liquid level change in the tank. Emptying losses occur when the air that is drawn into the tank during liquid removal saturates with hydrocarbon vapor and expands, thus exceeding the fixed capacity of the vapor space and overflowing through the pressure vacuum valve.[2]

Emissions from tank trucks in transit occur when gasoline vapor evaporates from (1) loaded tank trucks during transportation of gasoline from bulk terminals/plants to service stations, and (2) empty tank trucks returning from service stations to bulk terminals/plants.[3] Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations. Stage I gasoline distribution emissions also occur when gasoline vapors are displaced from storage tanks during unloading of gasoline from tank trucks at service stations (Gasoline Service Station Unloading) and from gasoline vapors evaporating from service station storage tanks and from the lines going to the pumps (Underground Storage Tank Breathing and Emptying).

The following SCCs are included in Stage I Gasoline Distribution:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4

2501050120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Terminals: All Evaporative Losses	Gasoline
2501055120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Plants: All Evaporative Losses	Gasoline
2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling
2501060052	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Splash Filling
2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling
2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying
2505030120	Storage and Transport	Petroleum and Petroleum Product Transport	Truck	Gasoline
2505040120	Storage and Transport	Petroleum and Petroleum Product Transport	Pipeline	Gasoline

b. Bulk Terminals and Pipelines

There are no generally accepted activity-based VOC emission factors for the pipelines and bulk terminals sectors because they are generally treated as point sources whose emissions are estimated using site-specific information. For example, emission estimates for bulk terminal storage tanks are typically derived from tank specific parameters that are input into the TANKS program.[4] Therefore, for bulk terminals and pipelines, EPA estimated 2008 national VOC emissions by multiplying 1998 national estimates developed in support of the Gasoline Distribution MACT standard[5] by the 2008 to 1998 ratio of the national volume of wholesale gasoline supplied (For 2011, EPA used 2008 emission estimates due to resource constraints). The gasoline supply information was obtained from Table 2 in Volume I of Petroleum Supply Annual 2008.[6]

Estimation of National 2008 VOC Emissions for Pipelines and Bulk Terminals

Category	1998 Post-MACT Control Emissions (Mg)	Mg to Ton Conversion Factor	1998 Emissions (tons)	Ratio of 2008 to 1998 Gasoline Supplied	2008 Emissions (tons)
Pipelines	79,830	1.1023	87,997	(8,989 thousand barrels per day / 8,253 thousand barrels per day) = 1.089	95,844
Bulk Terminals	137,555	1.1023	151,627		165,149

To estimate HAP emissions, EPA applied national average speciation profiles to the VOC emission estimates.[7] The table below presents these speciation profiles and the national bulk terminal and pipeline HAP emission estimates (note that unless otherwise noted, all emission values reported in this section exclude estimates for Puerto Rico and the U.S. Virgin Islands). EPA used total VOC emission estimates, so emissions represent total emissions. Where necessary, States should perform point source subtractions to obtain nonpoint emissions. The following describes how total national VOC estimates were allocated to counties.

HAP Speciation Profiles and 2008 Bulk Terminal and Pipeline Emissions

HAP	Pollutant Code	Percentage of VOC Emissions	Reference	2008 National Emissions (tons)	
				Bulk Terminals	Pipelines
Benzene	71432	0.27	7	4.46E+02	2.59E+02
2,2,4-Trimethylpentane	540841	0.75	7	1.24E+03	7.19E+02
Cumene	98828	0.012	7	1.98E+01	1.15E+01
Ethyl Benzene	100414	0.053	7	8.75E+01	5.08E+01
n-Hexane	110543	1.8	7	2.97E+03	1.73E+03
Naphthalene	91203	0.00027	7	4.46E-01	2.59E-01
Toluene	108883	1.4	7	2.31E+03	1.34E+03
Xylenes	1330207	0.56	7	9.25E+02	5.37E+02

For both categories, EPA allocated national VOC and HAP emissions for these categories in a two-step manner. First, EPA allocated emissions based on 2008 gasoline supply data reported by the U.S. Department of Energy (DOE). Next, EPA allocated emissions based on employment data reported in the 2007 County Business Patterns.[8]

For pipelines, EPA allocated emissions to Petroleum Administration for Defense (PAD) Districts based on the total amount of finished motor gasoline moved by pipeline in each PAD in year 2008. There are five PAD Districts across the United States: PAD District 1 comprises seventeen states plus the District of Columbia along the Atlantic Coast; PAD District 2 comprises fifteen states in the Midwest; PAD District 3 comprises six states in South Central U.S.; PAD District 4 comprises five states in the Rocky Mountains; and PAD District 5 comprises seven states along the West Coast. These data, which are displayed in the table below, are reported in Table 35 of Volume 1 of Petroleum

Supply Annual 2008.[9] Next, EPA allocated pipeline emissions in each PAD District to counties based on County Business Patterns employment data. Because employment data for NAICS code 48691 (Pipeline Transportation of Refined Petroleum Products) are often withheld due to confidentiality reasons, EPA used the number of employees in NAICS code 42471 (Petroleum Bulk Stations and Terminals) for this allocation. To better account for the location of refined petroleum pipelines, however, EPA did not allocate any activity to States which had employees in this NAICS code, but did not have employees in NAICS code 48691 (i.e., District of Columbia, Idaho, Maine, New Hampshire, Vermont, and West Virginia).

Movement of Finished Motor Gasoline by Pipeline Between PAD Districts, 2008

	From I	From II	From III	From IV	From V
To I	n/a	393	333,462	0	0
To II	70,895	n/a	99,167	7,442	0
To III	0	9,193	n/a	0	0
To IV	0	8,680	5,778	n/a	0
To V	0	0	25,453	9,287	n/a

For bulk terminals, EPA first allocated national emissions to States based on the 2008 refinery, bulk terminal, and natural gas plant stocks of motor gasoline reported for each State in Table 33 of Volume 1 of DOE's Petroleum Supply Annual 2008 (see table below).[9] Next, EPA allocated emissions in each State to counties based on the number of NAICS code 42471 (Petroleum Bulk Stations and Terminals) employees reported in the 2007 County Business Patterns.[8]

Refinery, Bulk Terminal, and Natural Gas Plant Stocks of Motor Gasoline, 2008

State	Motor Gasoline (Thousand Barrels)	State	Motor Gasoline (Thousand Barrels)
Alabama	1,090	Montana	872
Alaska	616	Nebraska	658
Arizona	470	Nevada	102
Arkansas	819	New Hampshire	0
California	460	New Jersey	2,956
Colorado	748	New Mexico	350
Connecticut	0	New York	1,469
Delaware	105	North Carolina	1,724
District of Columbia	0	North Dakota	291
Florida	1,877	Ohio	2,724
Georgia	1,724	Oklahoma	1,245
Hawaii	12	Oregon	525
Idaho	181	Pennsylvania	3,595
Illinois	1,940	Rhode Island	0
Indiana	2,464	South Carolina	720
Iowa	1,090	South Dakota	283

State	Motor Gasoline (Thousand Barrels)	State	Motor Gasoline (Thousand Barrels)
Kansas	2,347	Tennessee	923
Kentucky	1,045	Texas	9,530
Louisiana	5,209	Utah	793
Maine	374	Vermont	31
Maryland	31	Virginia	1,285
Massachusetts	0	Washington	1,902
Michigan	1,772	West Virginia	183
Minnesota	1,305	Wisconsin	704
Mississippi	1,580	Wyoming	910
Missouri	491		

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to bulk terminal and pipeline processes. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the two tables below.

Pipeline Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600501	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pipeline Leaks
40600502	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pipeline Venting
40600503	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pump Station
40600504	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Pipeline Petroleum Transport - General - All Products	Pump Station Leaks

Bulk Terminal Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400101	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400102	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400103	Petroleum and	Petroleum Liquids	Bulk Terminals	Gasoline RVP 7:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
	Solvent Evaporation	Storage (non-Refinery)		Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400104	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400105	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400106	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Breathing Loss (250000 Bbl Capacity) - Fixed Roof Tank
40400107	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Working Loss (Diam. Independent) - Fixed Roof Tank
40400108	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Working Loss (Diameter Independent) - Fixed Roof Tank
40400109	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Working Loss (Diameter Independent) - Fixed Roof Tank
40400110	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank
40400111	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank
40400112	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss (67000 Bbl Capacity)- Floating Roof Tank
40400113	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-	Bulk Terminals	Gasoline RVP 13: Standing Loss

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
		Refinery)		(250000 Bbl Cap.) - Floating Roof Tank
40400114	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
40400115	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
40400116	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk
40400117	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss (250000 Bbl Cap.) - Float Rf Tnk
40400118	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400119	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400120	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400131	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400132	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400133	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - External Floating Roof w/ Primary Seal
40400141	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400142	Petroleum and	Petroleum Liquids	Bulk Terminals	Gasoline RVP 10:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
	Solvent Evaporation	Storage (non-Refinery)		Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400143	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400148	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss - Ext. Float Roof (Pri/Sec Seal)
40400150	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Miscellaneous Losses/Leaks: Loading Racks
40400151	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Valves, Flanges, and Pumps
40400152	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Vapor Collection Losses
40400153	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Vapor Control Unit Losses
40400161	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
40400162	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Primary Seal
40400163	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - Internal Floating Roof w/ Primary Seal
40400171	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400172	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400173	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 7: Standing Loss - Int. Floating Roof w/ Secondary Seal

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400178	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Gasoline RVP 13/10/7: Withdrawal Loss - Int. Float Roof (Pri/Sec Seal)

c. Bulk Plants

EPA calculated VOC emissions from bulk plants by developing an average emission factor from the bulk plant motor gasoline VOC emissions and throughput data developed in support of the Gasoline Distribution MACT standards.[2,5] To estimate 2008 national VOC emissions, the VOC emission factor (8.62 pounds of VOC per 1,000 gallons) was applied to the estimated national volume of gasoline passing through bulk plants in 2008. The volume of bulk plant gasoline throughput was assumed to be 9 percent of total gasoline consumption.[10] Total gasoline consumption for 2008 was assumed to be the same as the volume of finished motor gasoline supplied as reported on the U.S. Energy Information Administration's Petroleum Navigator website.[11] The resulting national VOC emission estimate was then allocated to counties based on employment data for NAICS code 42471 (Petroleum Bulk Stations and Terminals). To estimate benzene emissions from bulk plants, EPA multiplied VOC emission estimates by county-level speciation profiles calculated from the annual onroad refueling (Stage 2) emissions from the 2008 NEI NMIM results.[12] All other HAPs were estimated by multiplying VOC emissions by the national average speciation profiles displayed in the table below.

Bulk Plant HAP Speciation Profiles and Total Emission Estimates

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	8.62 lb./1,000 gallons	2 and 5	5.35E+04
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	4.01E+02
Cumene	98828	0.012% of VOC	7	6.41E+00
Ethyl Benzene	100414	0.053% of VOC	7	2.83E+01
n-Hexane	110543	1.8% of VOC	7	9.62E+02
Naphthalene	91203	0.00027% of VOC	7	1.44E-01
Toluene	108883	1.4% of VOC	7	7.48E+02
Xylenes	1330207	0.56% of VOC	7	2.99E+02
Benzene	71432	county-specific % of VOC	12	3.94E+02

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to bulk plants. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the table below.

Bulk Plant Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400201	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400202	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400203	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400204	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400205	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400206	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400207	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400208	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400209	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400210	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400211	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400212	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400213	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400231	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400232	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Primary Seal
40400233	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - External Floating Roof w/ Primary Seal
40400241	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400242	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400243	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - Ext. Floating Roof w/ Secondary Seal
40400248	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10/13/7: Withdrawal Loss - Ext. Float Roof (Pri/Sec Seal)
40400250	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Loading Racks
40400251	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Valves, Flanges, and Pumps

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400252	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Miscellaneous Losses/Leaks: Vapor Collection Losses
40400253	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Miscellaneous Losses/Leaks: Vapor Control Unit Losses
40400261	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
40400262	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Primary Seal
40400263	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - Internal Floating Roof w/ Primary Seal
40400271	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400272	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400273	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 7: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400278	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Gasoline RVP 10/13/7: Withdrawal Loss - Int. Float Roof (Pri/Sec Seal)
40400401	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 13: Breathing Loss
40400402	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 13: Working Loss
40400403	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 10: Breathing Loss
40400404	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 10: Working Loss

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400405	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 7: Breathing Loss
40400406	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Petroleum Products - Underground Tanks	Gasoline RVP 7: Working Loss
40600101	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading **
40600126	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading **
40600131	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Normal Service)
40600136	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading (Normal Service)
40600141	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Balanced Service)
40600144	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Splash Loading (Balanced Service)
40600147	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Submerged Loading (Clean Tanks)

d. Tank Trucks in Transit

The EPA calculated VOC emissions from Tank Trucks in Transit by multiplying county-level tank truck gasoline throughput by a 0.06 lb of VOC per 1,000 gallon emission factor. As noted in the table below, this emission factor is the sum of the individual emission factors reported in the Gasoline Distribution EIIP guidance document for gasoline-filled trucks (traveling to service station/bulk plant for delivery) and vapor-filled trucks (traveling to bulk terminal/plant for reloading).[3] County-level gasoline consumption was estimated by summing county-level onroad and nonroad estimates. County-level onroad consumption was estimated by subtracting the NMIM-derived national nonroad consumption from the EIA's estimate of finished motor gasoline supplied and then allocating to counties using NMIM-derived onroad county-level CO_2 emissions.[11,13] County-level nonroad consumption was estimated by allocating NMIM-derived state/SCC-level nonroad gasoline consumption to the county-level based on nonroad county/SCC-level CO_2 emissions.[13] Gasoline throughput for tank trucks was computed by multiplying the county-level gasoline consumption estimates by a factor of 1.09 to account for gasoline that is transported more than once in a given area (i.e., transported from bulk terminal to bulk plant and then from bulk plant to service station).[10] Benzene emission estimates were calculated by multiplying county-level NMIM speciation profiles by the VOC emission estimates.[12] Emissions for the remaining HAPs were calculated by multiplying VOC emissions by the national speciation profiles presented in the second table below.

Tank Trucks in Transit VOC Emission Factors

	VOC Emission Factor
Vapor-Filled Trucks	0.055 lb/1,000 gallons
Gasoline Filled Trucks	0.005 lb/1,000 gallons
Total	**0.06 lb/1,000 gallons**

Tank Trucks in Transit HAP Speciation Profiles and Total Emission Estimates

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	0.06 lb./1,000 gallons	3	4.51E+03
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	3.38E+01
Cumene	98828	0.012% of VOC	7	5.41E-01
Ethyl Benzene	100414	0.053% of VOC	7	2.39E+00
n-Hexane	110543	1.8% of VOC	7	8.11E+01
Naphthalene	91203	0.00027% of VOC	7	1.22E-02
Toluene	108883	1.4% of VOC	7	6.31E+01
Xylenes	1330207	0.56% of VOC	7	2.52E+01
Benzene	71432	county-specific % of VOC	12	3.13E+01

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to tank trucks in transit. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the table below.

Tank Trucks in Transit Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40400154	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Terminals	Tank Truck Vapor Leaks
40400254	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)	Bulk Plants	Tank Truck Vapor Losses
40600162	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Loaded with Fuel (Transit Losses)
40600163	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Tank Cars and Trucks	Gasoline: Return with Vapor (Transit Losses)

e. Underground Storage Tank (UST) Breathing and Emptying

The EPA calculated VOC emissions from UST breathing and emptying by multiplying county-level total gasoline consumption, calculated as described above in the Tank Trucks in Transit section, by the 1 lb/1,000 gallons emission factor recommended by the Gasoline Distribution EIIP guidance document.[3] With the exception of benzene, HAP emissions were estimated by multiplying VOC emissions by the national HAP speciation profiles listed in the table below. To estimate benzene emissions, EPA multiplied VOC emissions by county-level speciation profiles from NMIM.[12]

Underground Storage Tank (UST) Breathing and Emptying Emissions

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	1 lb./1,000 gallons	3	6.89E+04
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	5.17E+02
Cumene	98828	0.012% of VOC	7	8.27E+00
Ethyl Benzene	100414	0.053% of VOC	7	3.65E+01
n-Hexane	110543	1.8% of VOC	7	1.24E+03
Naphthalene	91203	0.00027% of VOC	7	1.86E-01
Toluene	108883	1.4% of VOC	7	9.65E+02
Xylenes	1330207	0.56% of VOC	7	3.86E+02
Benzene	71432	county-specific % of VOC	12	4.78E+02

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to UST breathing and emptying. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the table below.

UST Breathing and Emptying Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600307	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Underground Tank Breathing and Emptying
40600707	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Underground Tank Breathing and Emptying

f. Gasoline Service Station Unloading

The EPA estimated uncontrolled VOC emissions from unloading of gasoline into service station tanks from county-level total gasoline consumption estimates, calculated as described above in the Tank Trucks in Transit section, and the following AP-42 equation:

$$L = (12.46 \times S \times P \times M)/T$$

where:

L = uncontrolled loading loss of liquid loaded (in lb/1,000 gallons)

S = saturation factor;

P = true vapor pressure of liquid loaded (pounds per square inch absolute);

M = molecular weight of vapors (lbs per lb/mole); and

T = temperature of liquid loaded (Rankine).[14]

This equation requires geographic-specific information. This information includes the saturation factor, which differs by method of loading (e.g., submerged filling), Reid vapor pressure (RVP), temperature, and true vapor pressure of gasoline.

Gasoline RVP values were obtained from the NMIM 2008 database. Because NMIM is a county-level database that reports RVP values by month, EPA developed county-level monthly gasoline consumption estimates by multiplying annual county gasoline consumption by monthly allocation factors. State-level monthly allocation factors were developed from monthly gasoline sales data reported in the Federal Highway Administration's Highway Statistics

$$P = \exp\left\{ \begin{array}{l} \left[0.7553 - \left(\dfrac{413.0}{T + 459.6}\right)\right] S^{0.5} \log_{10}(RVP) - \left[1.854 - \left(\dfrac{1{,}042}{T + 459.6}\right)\right] S^{0.5} \\ + \left[\left(\dfrac{2{,}416}{T + 459.6}\right) - 2.013\right] \log_{10}(RVP) - \left(\dfrac{8{,}742}{T + 459.6}\right) + 15.64 \end{array} \right\}$$

2008.[15] Geographic-specific information on the temperature of gasoline and the method of loading were obtained from a Stage I and II gasoline emission inventory study prepared for the EIIP.[16]

The true vapor pressure of gasoline was estimated for each county/month using the following equation:

where:

P	=	Stock true vapor pressure, in pounds per square inch absolute.
T	=	Stock temperature, in degrees Fahrenheit.
RVP	=	Reid vapor pressure, in pounds per square inch.
S	=	Slope of the ASTM distillation curve at 10 percent evaporated, in degrees Fahrenheit per percent (assumed that S = 3.0 for gasoline per Figure 7.1-14a of AP-42).[17]

This equation was used to calculate monthly county-level true vapor pressure estimates. In cases where more than one filling method was assumed to apply in a county (e.g., due to vapor balancing requirement applying to a portion of a county's total gasoline throughput due to a throughput exemption), EPA developed two sets of calculations for each month, one for each filling method.

The EIIP study regional stock temperature information was used to estimate the temperature of gasoline in each county in each month (see table below).[16]

Temperature Data Used in Estimating True Vapor Pressure (ºF)

Region	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
1 (Northeast)	46	44	44	48	57	64	70	73	70	64	60	51
2 (Southeast)	66	67	69	74	78	81	80	81	80	77	69	60
3 (Southwest)	60	61	62	66	73	78	81	84	82	78	71	62
4 (Midwest)	33	35	40	47	55	62	71	73	68	65	64	63
5 (West)	50	52	62	66	73	76	80	83	86	84	73	60
6 (Northwest)	49	50	50	52	57	62	67	72	68	60	49	42

Region 1: Alaska, Connecticut, Delaware, DC, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, Wisconsin

Region 2: Alabama, Arkansas, Florida, Georgia, Hawaii, Louisiana, Mississippi, N. Carolina, S. Carolina, Tennessee

Region 3: Arizona, New Mexico, Oklahoma, Texas

Region 4: Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, N. Dakota, S. Dakota, Wyoming

Region 5: California, Nevada, Utah

Region 6: Idaho, Oregon, Washington

The EPA incorporated the effect of Stage I Gasoline Service Station vapor balancing controls based on the county-level control efficiency values (either 90 or 95 percent) that were compiled for the EIIP study.[16] The table below presents the HAP speciation profiles and total VOC and HAP emission estimates calculated using these procedures.

Emissions are reported by SCC based on the filling methods used in each county as determined from the EIIP study: SCC 2501060051 (Submerged Filling); SCC 2501060052 (Splash Filling); and SCC 2501060053 (Balanced Submerged Filling).

Stage I Service Station Unloading HAP Speciation Profiles and Total Emission Estimates

Pollutant	Pollutant Code	Emission Factor	Reference	National Emissions (tpy)
VOC	VOC	Equation 1	14	3.82E+05
2,2,4-Trimethylpentane	540841	0.75% of VOC	7	2.86E+03
Cumene	98828	0.012% of VOC	7	4.58E+01
Ethyl Benzene	100414	0.053% of VOC	7	2.02E+02
n-Hexane	110543	1.8% of VOC	7	6.87E+03
Naphthalene	91203	0.00027% of VOC	7	1.03E+00
Toluene	108883	1.4% of VOC	7	5.35E+03
Xylenes	1330207	0.56% of VOC	7	2.14E+03
Benzene	71432	county-specific % of VOC	12	2.97E+03

It is important to reiterate that the above discussion addresses the calculation of total VOC emissions. The 2008 point source NEI reports VOC emissions related to service station unloading. To obtain nonpoint emissions, States should subtract the 2008 point source VOC emission estimates from the total VOC emission estimates reported here. The relevant point source SCCs are listed in the three tables below below.

Service Station Unloading: Submerged Fill Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600302	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Submerged Filling w/o Controls
40600702	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Submerged Filling w/o Controls

Service Station Unloading: Splash Fill Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600301	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Splash Filling
40600701	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Splash Filling

Service Station Unloading: Balanced Submerged Fill Point Source SCCs

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
40600305	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Unloading **
40600306	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Gasoline Retail Operations - Stage I	Balanced Submerged Filling
40600706	Petroleum and Solvent Evaporation	Transportation and Marketing of Petroleum Products	Consumer (Corporate) Fleet Refueling - Stage I	Balanced Submerged Filling

Unloading emissions might also be reported in the point source inventory under SCC 40600399 (Gasoline Retail Operations – Stage I, Not Classified).

g. Example Emission Calculations

Bulk Terminals

2008 national benzene emissions = VOC emissions x HAP speciation factor

1.65E+05 tons x 0.0027

4.46E+02 tons

Pipelines

2008 national cumene emissions = VOC emissions x HAP speciation factor

9.58E+04 tons x 0.00012

1.15E+01 tons

Bulk Plants

2008 national VOC emissions

= national gasoline consumption x proportion passing through bulk plants x VOC emission factor

= 137,801,370 thousand gallons x 0.09 x 8.62 lbs. VOC/thousand gallons

= 1.07E+08 lbs. / 2000 lbs.

= 5.35E+04 tons

Tank Trucks in Transit

2008 Alamance County, North Carolina VOC emissions

= total county gasoline consumption x (1+proportion of gasoline transported twice) x VOC emission factor

= 61,446 thousand gallons x (1+0.09) x 0.06 lbs. VOC/thousand gallons

= 4.02E+03 lbs. / 2000 lbs.

= 2.01E+00 tons

UST Breathing and Emptying

2008 Alamance County, North Carolina VOC emissions

= total county gasoline consumption x VOC emission factor

= 61,466 thousand gallons x 1 lb. VOC/thousand gallons

= 6.15E+04 lbs. / 2000 lbs.

= 30.73E+00 tons

Stage I Gasoline Service Station Unloading - uncontrolled VOC emissions in July for balanced submerged fill unloading in Alamance County, NC

= annual county consumption x proportion of annual gasoline sold in July x VOC emission factor

= 61,466 thousand gallons x 0.1087 x VOC emission factor

= 6,681 thousand gallons x ((12.46 x saturation factor x true vapor pressure x vapor molecular weight) / temperature))

= 6,681 thousand gallons x ((12.46 x 1.0 x 6.309 x 67.811) / 540)

= 65,950 lbs

Incorporate effect of control (vapor balancing requirement)

= Uncontrolled emissions x ((100-CE)/100)

= 65,950 lbs x ((100-90)/100)

= 6,595 lbs / 2,000 lbs

= 3.30E+00 tons

h. References

1. U.S. Environmental Protection Agency, “National Emission Standards for Source Categories: Gasoline Distribution (Stage I), 40 CFR Part 63.” Office of Air Quality Planning and Standards, February 28, 1997. Pages 9087-9093.

2. U.S. Environmental Protection Agency, "Gasoline Distribution Industry (Stage I)-Background Information for Proposed Standards," EPA-453/R94-002a, Office of Air Quality Planning and Standards, January 1994.

3. Eastern Research Group, Inc., "Volume III: Chapter 11, Gasoline Marketing (Stage I and Stage II), Revised Final," prepared for the Emission Inventory Improvement Program, January 2001.

4. U.S. Environmental Protection Agency, “TANKS Emission Estimation Software,” Office of Air Quality Planning and Standards, Emission Inventory Group, available from http://www.epa.gov/ttn/chief/software/tanks/index.html, last updated October 29, 2004.

5. U.S. Environmental Protection Agency, "Gasoline Distribution Industry (Stage I)-Background Information for Promulgated Standards," EPA-453/R94-002b, Office of Air Quality Planning and Standards, November 1994.

6. U.S. Department of Energy, Energy Information Administration, “U.S. Daily Average Supply and Distribution of Crude Oil and Petroleum Products,” Table 2 in *Petroleum Supply Annual 2008, Volume 1*, retrieved from http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1.html, released June 2009.

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8. U.S. Department of Commerce, Bureau of the Census, County Business Patterns 2007, retrieved from http://www.census.gov/econ/cbp/index.html, released July 2009.

9. U.S. Department of Energy, Energy Information Administration, "Refinery, Bulk Terminal, and Natural Gas Plant Stocks of Selected Petroleum Products by PAD District and State, 2008” and "Movements of Crude Oil and Petroleum Products by Pipeline Between PAD Districts, 2008," Tables 33 and 35 in *Petroleum Supply Annual 2008, Volume 1*, retrieved from http://www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/psa_volume1.html, released June 2009.

10. Cavalier, Julia, MACTEC, Inc., personal communication, "RE: Percentage of Gasoline Transported Twice By Truck," with Stephen Shedd, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emission Standards Division, July 6, 2004.

11. U.S. Department of Energy, Energy Information Administration, Petroleum Navigator – Product Supplied, available from http://tonto.eia.doe.gov/dnav/pet/pet_cons_psup_dc_nus_mbblpd_a.htm, accessed January 2010.

12. Benzene speciation profiles calculated by Jonathan Dorn, E.H. Pechan and Associates, Inc. from county-level VOC and benzene emissions developed from a 2008 NMIM run. The NMIM run was performed by John Van Bruggen, E.H. Pechan and Associates, Inc., January 2010.

13. 2008 NMIM runs performed by John Van Bruggen and Melissa Spivey, E.H. Pechan and Associates, Inc., January 2010.

14. U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 5.2 Transportation and Marketing of Petroleum Liquids," Office of Air Quality Planning and Standards, January 1995.

15. Federal Highway Administration, “Monthly Gasoline/Gasohol Reported by States,” Table MF-33GA in *Highway Statistics 2008*, Office of Highway Policy Information, available from http://www.fhwa.dot.gov/policyinformation/statistics/2008/, accessed January 2010.

16. Pacific Environmental Services, Inc., "Draft Summary of the Analysis of the Emissions Reported in the 1999 NEI for Stage I and Stage II Operations at Gasoline Service Stations," prepared for the U.S. Environmental Protection Agency and the Emission Inventory Improvement Program, September 2002.

17. U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 7: Liquid Storage Tanks," Office of Air Quality Planning and Standards, Emission Inventory Group, September 1997.

8.19 Open Burning: Household Waste and Municipal Solid Waste

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Open burning of residential municipal solid waste (MSW) is the purposeful burning of MSW in outdoor areas. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates for MSW burning are a function of the amount of waste burned per year.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2610030000	Waste Disposal, Treatment, and Recovery	Open Burning	Residential	Household Waste (use 26-10-000-xxx for Yard Wastes)

b. Activity Data

The amount of household MSW burned was estimated using data from EPA's report *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*.[1,2] The report presents the total mass of waste generated from the residential and commercial sectors in the United States by type of waste for the calendar year 2010. According to the EPA report, residential waste generation accounts for 55-65 percent of the total waste from the residential and commercial sectors.[3] For the calculation of per capita household waste subject to burning, the median value of 60 percent was assumed. This information was used to calculate a daily estimate of the per capita household waste subject to burning of 1.94 lbs/person/day. Non-combustible waste, such as glass and metals, was not considered to be waste subject to burning. Burning of yard waste is included in SCC 2610000100 and SCC 2610000400; therefore, it is not part of residential MSW. Approximately 25 to 32 percent of all waste that is subject to open burning is actually burned.[4,5] A median value of 28 percent is assumed to be burned in all counties in the United States.

Since open burning is generally not practiced in urban areas, only the rural population of each county was assumed to practice open burning. The ratio of urban to rural population was obtained from 2010 U.S. Census data.[6] This ratio was then multiplied by the 2010 U.S. Census Bureau estimate of the population in each county to obtain the county-level rural population for 2010.[7] The county-level rural population was then multiplied by the per capita household waste subject to burning to determine the amount of rural household MSW generated in each county in 2010.

c. Controls

Controls for residential MSW burning are generally in the form of a ban on open burning of waste in a given municipality or county. Counties that were more than 80% urban were assumed not to practice any open burning. Therefore, criteria pollutant and HAP emissions from residential municipal solid waste burning are zero in these counties. In addition, the State of Colorado implemented a state-wide ban on open burning. Emissions from open burning of residential waste in all Colorado counties were assumed to be zero.

d. Emission Factors

Emission factors are reported in the table below. Emission factors for CAPs were developed by the U.S. Environmental Protection Agency (EPA) in consultation with the Eastern Regional Technical Advisory Committee and based primarily on the AP-42 report.[8,9] Emission factors for HAPs are from an EPA Control Technology Center report and emission factors for 17 dioxin congeners were obtained from an EPA dioxin report.[10,11]

Emission Factors for Open Burning of Residential MSW (2610030000)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference	Emission Factor Verification
CO	CO	8.50E+01	Reference 9	Correct
NO_X	NO_X	6.00E+00	Reference 9	Correct
PM_{10}-FIL	PM_{10}-FIL	3.80E+01	Reference 8	Could not access reference paper.
PM_{10}-PRI	PM_{10}-PRI	3.80E+01	Reference 8	Could not access reference paper.
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	3.48E+01	Reference 8	Could not access reference paper.
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	3.48E+01	Reference 8	Could not access reference paper.
SO_2	SO_2	1.00E+00	Reference 9	Correct
VOC	VOC	8.56E+00	Reference 8	Could not access reference paper.
1,2,3,4,6,7,8-heptachlorodibenzofuran	67562394	2.48E-07	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	35822469	7.96E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,7,8,9-heptachlorodibenzofuran	55673897	3.00E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,7,8-hexachlorodibenzofuran	70648269	2.28E-07	Reference 11	Could not find emission factor in reference paper.
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227286	1.28E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,6,7,8-hexachlorodibenzofuran	57117449	7.70E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653857	1.94E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,7,8,9-hexachlorodibenzofuran	72918219	5.00E-09	Reference 11	Could not find emission factor in reference paper.
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408743	3.80E-08	Reference 11	Could not find emission factor in reference paper.

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference	Emission Factor Verification
1,2,3,7,8-pentachlorodibenzofuran	57117416	7.44E-08	Reference 11	Could not find emission factor in reference paper.
1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321764	1.62E-08	Reference 11	Could not find emission factor in reference paper.
1,2,4-trichlorobenzene	120821	1.95E-04	Reference 10	Doesn't match Table 4.4
1,4-dichlorobenzene	106467	6.65E-05	Reference 10	Doesn't match Table 4.4
2,3,4,6,7,8-hexachlorodibenzofuran	60851345	1.24E-07	Reference 11	Could not find emission factor in reference paper.
2,3,4,7,8-pentachlorodibenzofuran	57117314	1.30E-07	Reference 11	Could not find emission factor in reference paper.
2,3,7,8-tetrachlorodibenzofuran	51207319	9.12E-08	Reference 11	Could not find emission factor in reference paper.
2,3,7,8-tetrachlorodibenzo-p-dioxin	1746016	5.40E-09	Reference 11	Could not find emission factor in reference paper.
Acenaphthene	83329	1.54E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Acenaphthylene	208968	2.26E-02	Reference 10	Matches value in Table 4.4
Acetalaldehyde	75070	8.57E-01	Reference 10	Not in paper anywhere
Acrolein	107028	6.19E-02	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Anthracene	120127	3.66E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benz[a]anthracene	56553	4.48E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzene	71432	2.48E+00	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[a]pyrene	50328	4.24E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[b]fluoranthene	205992	5.26E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[g,h,i,]Perylene	191242	3.95E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Benzo[k]fluoranthene	207089	2.05E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Chlorobenzene	108907	8.48E-04	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference	Emission Factor Verification
Chrysene	218019	5.07E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Dibenzo[a,h]anthracene	53703	6.46E-04	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Fluoranthene	206440	8.14E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Fluorene	86737	7.31E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Hexachlorobenzene	118741	4.40E-05	Reference 10	Matches value in Table 4.4
Hydrochloric Acid	7647010	5.68E-01	Reference 10	Matches value in Table 4.4 but why not using the highest value as compared to the lowest?
Hydrogen Cyanide	74908	9.36E-01	Reference 10	Matches value in Table 4.4
Indeno[1,2,3-c,d]pyrene	193395	3.75E-03	Reference 10	
Naphthalene	91203	3.51E-02	Reference 10	Matches value in Table 4.4
Octachlorodibenzofuran	39001020	7.28E-08	Reference 11	Could not find emission factor in reference paper.
Octachlorodibenzo-p-dioxin	3268879	9.94E-08	Reference 11	Could not find emission factor in reference paper.
Pentachlorophenol	87865	1.06E-04	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Phenanthrene	85018	1.46E-02	Reference 10	Matches value in Table 4.4
Phenol	108952	2.80E-01	Reference 10	Matches value in Table 4.4
Polychlorinated Biphenyls	1336363	5.72E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Pyrene	129000	9.66E-03	Reference 10	Contaminants not listed in Table 4.4 were assumed to be correct and data results averaged.
Styrene	100425	1.48E+00	Reference 10	Matches value in Table 4.4

e. Emissions

County-level criteria pollutant and HAP emissions were calculated by multiplying the total amount of residential municipal solid waste burned per year by an emission factor.

f. Example Calculations

VOC emissions in Autauga County, Alabama from open burning of residential MSW:

Population of Autauga County in 2010 = 54,571

Rural fraction of Autauga County population = 0.42

Per capita MSW generated (lb/person/day) = 1.9435

Fraction of rural population that burns MSW = 0.28

Number of days in a year = 365

Factor to convert from lbs to tons = 1/2000

2010 MSW burning activity in Autauga County = 54,571 * 0.42 * 1.9435 * 0.28 * 365 * 1/2000

2010 MSW activity in Autauga County = 2,276 tons

VOC emissions = MSW burned * VOC emission factor

VOC emission factor = 8.56 lb/ton

VOC emissions from MSW burning in Autauga County = 2,276 tons * 8.56 lbs/ton * 1 ton/2000 lbs

VOC emissions from MSW burning in Autauga County in 2010 = 9.74 tons

g. QA/QC

I. Methodology

The methodology was reviewed and understood with no questions. EIIP information was also reviewed and survey information may be beneficial to update Missouri emission factors.

II. Data

The data was checked for the listed emission factors in the emission factor table above. Please see column 5 of that table for emission factor review comments. Many emission factors could be found, some could not be replicated from the Reference documents available. Despite these shortcomings, the amount of time to find replacement emission factors is prohibitive, so EPA's factors will be accepted for 2011. ***For future NEI submittals, Missouri will spend more time on verification of emission factors and retrieving reference materials.***

III. Math

The formulas from the excel spreadsheet data were check and verified with no discrepancies.

IV. Overall

Missouri will accept EPA's estimates for the residential municipal solid waste burning category despite unverified emission factors.

h. References

1. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 1. Materials Generated in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

2. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 2. Materials Recovered in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

3. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010—Fact Sheet*," p. 4,December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf (accessed April 2012).

4. U.S. Environmental Protection Agency, Region V. "Emission Characteristics of Burn Barrels." Prepared by Two Rivers Regional Council of Public Officials and Patrick Engineering, Inc. June 1994.

5. *Garbage Burning in Rural Minnesota: Key Results and Findings*, prepared by Zenith Research Group for Minnesota Pollution Control Agency, June 2010, available at http://www.pca.state.mn.us/index.php/view-document.html?gid=14316 (accessed June 10, 2011).

6. U.S. Census Bureau, Decennial Censuses, 2010 Census: SF1, Table P2

7. U.S. Census Bureau. *Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2011 (NST-EST2011-01),* available at http://www.census.gov/popest/data/national/totals/2011/index.html (accessed April 2012).

8. Huntley, Roy, U.S. Environmental Protection Agency, "state_comparison ERTAC SS_version7_3 Oct 20 2009 [electronic file]," November 5, 2009.

9. United States Environmental Protection Agency, Office of Air Quality Planning and Standards. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 2.5 Open Burning*. Research Triangle Park, NC. October 1992.

10. U.S. Environmental Protection Agency, Control Technology Center. "Evaluation of Emissions from the Open Burning of Household Waste in Barrels." EPA-600/R-97-134a. November 1997.

11. United States Environmental Protection Agency, Office of Research and Development. *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzeno-p-Dioxin (TCCD) and Related Compounds. Part I: Estimating Exposure to Dioxin-Like Compounds. Volume 2: Sources of Dioxin-Like Compounds in the United States*. EPA/600/P-00/001Ab. Washington D.C. March 2001.

8.20 Open Burning: Land Clearing Debris

The Missouri DNR accepted EPA's estimates of emissions for this source category, but added Hazardous Air Pollutant data to EPA's Criteria Air Pollutant data. The documentation below was developed by EPA.

a. Source Category Description

Open burning of land clearing debris is the purposeful burning of debris, such as trees, shrubs, and brush, from the clearing of land for the construction of new buildings and highways. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates from open burning of land clearing debris are a function of the amount of material or fuel subject to burning per year.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)

b. Activity Data

The amount of material burned was estimated using the county-level total number of acres disturbed by residential, non-residential, and road construction. County-level weighted loading factors were applied to the total number of construction acres to convert acres to tons of available fuel.

<u>Acres Disturbed from Residential Construction</u>

The US Census Bureau has 2010 data for *Housing Starts - New Privately Owned Housing Units Started*[1] which provides regional level housing starts based on the groupings of 1 unit, 2-4 units, 5 or more units. A consultation with the Census Bureau in 2002 gave a breakdown of approximately 1/3 of the housing starts being for 2 unit structures, and 2/3 being for 3 and 4 unit structures. The 2-4 unit category was divided into 2-units, and 3-4 units based on this ratio. To determine the number of structures for each grouping, the 1 unit category was divided by 1, the 2 unit category was divided by 2, and the 3-4 unit category was divided by 3.5. The 5 or more unit category may be made up of more than one structure. *New Privately Owned Housing Units Authorized Unadjusted Units*[2] gives a conversion factor to determine the ratio of structures to units in the 5 or more unit category. For example if a county has one 40 unit apartment building, the ratio would be 40/1. If there are 5 different 8 unit buildings in the same project, the ratio would be 40/5. Structures started by category are then calculated at a regional level. The table *Annual Housing Units Authorized by Building Permit*[3] has 2010 data at the county level to allocate regional housing starts to the county level. This results in county level housing starts by number of units. The following surface areas were assumed disturbed for each unit type:

Surface Acres Disturbed per Unit Type

1-Unit	1/4 acre/structure
2-Unit	1/3 acre/structure
Apartment	1/2 acre/structure

The 3-4 unit and 5 or more unit categories were considered to be apartments. Multiplication of housing starts to surface acres disturbed results in total number of acres disturbed for each unit category.

<u>Acres Disturbed from Non-Residential Construction</u>

Annual Value of Construction Put in Place in the U.S[4] has the 2011 National Value of Non-residential construction. The national value of non-residential construction put in place (in millions of dollars) was allocated to counties

using county-level non-residential construction (NAICS Code 2362) employment data obtained from *County Business Patterns*[5] *(CBP)*. Because some county employment data was withheld due to privacy concerns, the following procedure was adopted:

4. State totals for the known county level employees were subtracted from the number of employees reported in the state level version of CBP. This results in the total number of withheld employees in the state.

5. A starting estimate of the midpoint of the range code was used (so for instance in the 1-19 employees range, an estimate of 10 employees would be used) and a state total of the withheld counties was computed.

6. A ratio of estimated employees (Step 2) to withheld employees (Step 1) was then used to adjust the county level estimates up or down so the state total of adjusted guesses should match state total of withheld employees (Step 1)

In 1999 a figure of 2 acres/$\$10^6$ was developed. The Bureau of Labor Statistics *Producer Price Index*[6] lists costs of the construction industry from 1999-11

$$\begin{aligned} \text{2011 acres per } \$10^6 &= \text{1999 acres per } \$10^6 \text{ x (1999 PPI / 2011 PPI)} \\ &= 2 \text{ acres}/\$10^6 \text{ (132.9 / 229.3)} \\ &= 1.159 \text{ acres per } \$10^6 \end{aligned}$$

Acres Disturbed by Road Construction

The Federal Highway Administration provides data on spending by state in several different categories of road construction and maintenance in *Highway Statistics, Section IV - Highway Finance, Table SF-12A, State Highway Agency Capital Outlay*[7] for 2008. (Note that this table has not been available in subsequent versions of *Highway Statistics*. Thus, 2008 is the latest data currently available.) For this SCC, the following sets of data (or columns) are used: New Construction, Relocation, Added Capacity, Major Widening, and Minor Widening. Each of these data sets are also differentiated according to the following six roadway classifications:

1. Interstate, urban
2. Interstate, rural
3. Other arterial, urban
4. Other arterial, rural
5. Collectors, urban
6. Collectors, rural

The State expenditure data are then converted to new miles of road constructed using \$/mile conversions obtained from the North Carolina Department of Transportation (NCDOT) in 2000. A conversion of \$4 million/mile was applied to the interstate expenditures. For expenditures on other arterial and collectors, a conversion factor of \$1.9 million/mile was applied, which corresponds to all other projects.

The new miles of road constructed are used to estimate the acreage disturbed due to road construction. The total area disturbed in each state was calculated by converting the new miles of road constructed to acres using an acres disturbed/mile conversion factor for each road type as given in the table below:

Spending per Mile and Acres Disturbed per Mile by Highway Type

Road Type	Thousand Dollars per mile	Acres Disturbed per mile
Urban Areas, Interstate	4000	15.2
Rural Areas, Interstate	4000	15.2
Urban Areas, Other Arterials	1900	15.2
Rural Areas, Other Arterials	1900	12.7
Urban Areas, Collectors	1900	9.8
Rural Areas, Collectors	1900	7.9

County-level building permits data are used to allocate the state-level acres disturbed by road construction to the county.[8] A ratio of the number of building starts in each county to the total number of building starts in each state was applied to the state-level acres disturbed to estimate the total number of acres disturbed by road construction in each county.

Converting Acres Disturbed to Tons of Land Clearing Debris Burned

Version 2 of the Biogenic Emissions Land cover Database (BELD2) within EPA's Biogenic Emission Inventory System (BEIS) was used to identify the acres of hardwoods, softwoods, and grasses in each county. The table below presents the average fuel loading factors by vegetation type. The average loading factors for slash hardwood and slash softwood were adjusted by a factor of 1.5 to account for the mass of tree that is below the soil surface that would be subject to burning once the land is cleared.[9] Weighted average county-level loading factors were calculated by multiplying the average loading factors by the percent contribution of each type of vegetation class to the total land area for each county.

Fuel Loading Factors by Vegetation Type

Vegetation Type	Unadjusted Average Fuel Loading Factor (Ton/acre)	Adjusted Average Fuel Loading Factor (Ton/acre)
Hardwood	66	99
Softwood	38	57
Grass	4.5	Not Applicable

The total acres disturbed by all construction types was calculated by summing the acres disturbed from residential, non-residential, and road construction. The county-level total acres disturbed were then multiplied by the weighted average loading factor to derive tons of land clearing debris.

c. Controls

Controls for land clearing debris burning are generally in the form of a ban on open burning of waste in a given municipality or county. Counties that were more than 80% urban were assumed not to practice any open burning. Therefore, criteria pollutant and HAP emissions from open burning of land clearing debris are zero in these counties. In addition, the State of Colorado implemented a state-wide ban on open burning. Emissions from open burning of land clearing debris in all Colorado counties were assumed to be zero.

d. Emission Factors

Emission factors are reported in the table below. Emission factors for CAPs were developed by the U.S. Environmental Protection Agency (EPA) in consultation with the Eastern Regional Technical Advisory Committee and based primarily on the AP-42 report.[10,11] The $PM_{2.5}$ to PM_{10} emission factor ratio for brush burning (0.7709) was multiplied by the PM_{10} emission factors for land clearing debris burning to develop $PM_{2.5}$ emission factors. Emission factors for HAPs are from an EPA Control Technology Center report[12] and emission factors for 17 dioxin congeners were obtained from an EPA dioxin report.[13] The dioxin emission factors were multiplied by 0.002 to convert from mg/kg to lb/ton.

Emission Factors for Open Burning of Land Clearing Debris (SCC 2610000500)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
VOC	VOC	11.6	Reference 10
NO_X	NO_X	5	Reference 10
CO	CO	169	Reference 10
PM_{10}-FIL	PM_{10}-FIL	17	Reference 10

$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	13.1	PM_{10}-FIL multiplied by 0.7709
PM_{10}-PRI	PM_{10}-PRI	17	Reference 10
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	13.1	PM_{10}-PRI multiplied by 0.7709
1,2,3,4,6,7,8-HpCDD	35822469	3.33E-07	Reference 13
1,2,3,4,6,7,8-HpCDF	67562394	5.08E-08	Reference 13
1,2,3,4,7,8,9-HpCDF	55673897	6.12E-09	Reference 13
1,2,3,4,7,8-HxCDD	39227286	1.14E-08	Reference 13
1,2,3,4,7,8-HxCDF	70648269	3.34E-08	Reference 13
1,2,3,6,7,8-HxCDD	57653857	2.14E-08	Reference 13
1,2,3,6,7,8-HxCDF	57117449	1.43E-08	Reference 13
1,2,3,7,8,9-HxCDD	19408743	3.47E-08	Reference 13
1,2,3,7,8,9-HxCDF	72918219	2.23E-09	Reference 13
1,2,3,7,8-PeCDD	40321764	7.66E-09	Reference 13
1,2,3,7,8-PeCDF	57117416	1.27E-08	Reference 13
2,3,4,6,7,8-HxCDF	60851345	1.96E-08	Reference 13
2,3,4,7,8-PeCDF	57117314	2.02E-08	Reference 13
2,3,7,8-TCDD	1746016	2.30E-09	Reference 13
2,3,7,8-TCDF	51207319	1.40E-08	Reference 13
Cumene	98828	1.33E-02	Reference 12
Dibenzofuran	132649	6.75E-03	Reference 12
Ethyl Benzene	100414	4.80E-02	Reference 12
OCDD	3268879	1.33E-06	Reference 13
OCDF	39001020	2.05E-08	Reference 13
Phenol	108952	1.15E-01	Reference 12
Styrene	100425	1.02E-01	Reference 12

e. Emissions

County-level criteria pollutant and HAP emissions were calculated by multiplying the total mass of land clearing debris burned per year by an emission factor.

f. Example Calculations

VOC emissions in Autauga County, Alabama from open burning of land clearing debris:

Rural fraction of Autauga County population = 0.42, so no emission controls

Acres disturbed by residential, non-residential, and road construction in Autauga County = 84.83
Weighted average fuel loading factor for Autauga County = 65.48 tons/acre

Mass of land clearing debris burned = 84.83 acres * 65.48 tons/acre = 5,555 tons

VOC emission factor = 11.6 lbs/ton
Factor to convert from lbs to tons = 1/2000

VOC emissions = tons of land clearing debris burned * VOC emission factor

VOC emissions from land clearing debris burning = 5,555 tons * 11.6 lbs/ton * 1 ton/2000 lbs

VOC emissions from land clearing debris burning in Autauga County in 2010 = 32 tons

g. QA/QC

1. Surrogate methods seem reasonable for determining activity level for land clearing for residential, non-residential, and road construction.
2. Reference 10, "state_comparison ERTAC SS_version7_3 Oct 20 2009" cannot be found. The closest document that can be found is "state_comparison_ERTAC_SS_version7.2_23nov2009." The values in the two documents for emissions from open burning of land-clearing debris appear to be the same.
3. The values for the non-residential category in "Value of Private Construction Put in Place - Not Seasonally Adjusted" do not match the values shown in the reference at http://www.census.gov/const/C30/priv2011.pdf. This same discrepancy was found in the non-residential construction- fugitive dust category. The corrected values are used to update the calculation of the number of acres cleared and affected by open burning for land clearing.
4. The estimate of acres disturbed from non-residential construction uses an assumed value from 1999 of 2 acres/$\$10^6$, which is adjusted to 2011. The source of the 2 acres/$\$10^6$ is not given and cannot be verified.

h. References

1. U.S. Census Bureau, "New Privately Owned Housing Units Started for 2010 (Not seasonally adjusted)," available at http://www.census.gov/const/startsua.pdf

2. U.S. Census Bureau, "Table 2au. New Privately Owned Housing Units Authorized Unadjusted Units for Regions, Divisions, and States, Annual 2010" available at http://www.census.gov/const/C40/Table2/tb2u2010.txt

3. Annual Housing Units Authorized by Building Permits CO2010A, purchased from US Department of Census

4. U.S. Census Bureau, "Annual Value of Construction Put in Place," available at http://www.census.gov/const/www/ototpage.html

5. U.S. Census Bureau, "County Business Patterns," available at http://www.census.gov/econ/cbp/index.html

6. Bureau of Labor Statistics, Producer Price Index, Table BMNR, available at http://www.bls.gov/data/

7. Federal Highway Administration, 2008 Highway Spending, available at http://www.fhwa.dot.gov/policyinformation/statistics/2008/sf12a.cfm
8. 2008 Building Permits data from US Census "BPS01", http://www.census.gov/support/USACdataDownloads.html

9. Ward, D.E., C.C. Hardy, D.V. Sandberg, and T.E. Reinhardt. "Mitigation of Prescribed Fire Atmospheric Pollution through Increased Utilization of Hardwoods, Piled Residues, and Long-Needled Conifers." Final Report. USDA Forest Service, Pacific Northwest Research Station, Fire and Air Resource Management. 1989.

10. Huntley, Roy, U.S. Environmental Protection Agency, "state_comparison ERTAC SS_version7_3 Oct 20 2009 [electronic file]," November 5, 2009.

11. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 2.5 Open Burning*. Research Triangle Park, NC. October 1992.

12. U.S. Environmental Protection Agency, "Evaluation of Emissions from the Open Burning of Household Waste in Barrels, EPA-600/R-97-134a," Control Technology Center. November 1997.

13. Gullet, B.K. and T. Abderrahmne, "PCDD/F Emissions from Forest Fire Simulations," *Atmospheric Environment*, Vol. 37, No. 6, pp. 803-813. February 2003.

Emission Factors for Open Burning of Land Clearing Debris (SCC 2610000500)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
VOC	VOC	11.6	Reference 10
NO_X	NO_X	5	Reference 10
CO	CO	169	Reference 10
PM_{10}-FIL	PM_{10}-FIL	17	Reference 10
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	13.1	PM_{10}-FIL multiplied by 0.7709
PM_{10}-PRI	PM_{10}-PRI	17	Reference 10
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	13.1	PM_{10}-PRI multiplied by 0.7709
1,2,3,4,6,7,8-HpCDD	35822469	3.33E-07	Reference 13
1,2,3,4,6,7,8-HpCDF	67562394	5.08E-08	Reference 13
1,2,3,4,7,8,9-HpCDF	55673897	6.12E-09	Reference 13
1,2,3,4,7,8-HxCDD	39227286	1.14E-08	Reference 13
1,2,3,4,7,8-HxCDF	70648269	3.34E-08	Reference 13
1,2,3,6,7,8-HxCDD	57653857	2.14E-08	Reference 13
1,2,3,6,7,8-HxCDF	57117449	1.43E-08	Reference 13
1,2,3,7,8,9-HxCDD	19408743	3.47E-08	Reference 13
1,2,3,7,8,9-HxCDF	72918219	2.23E-09	Reference 13
1,2,3,7,8-PeCDD	40321764	7.66E-09	Reference 13
1,2,3,7,8-PeCDF	57117416	1.27E-08	Reference 13
2,3,4,6,7,8-HxCDF	60851345	1.96E-08	Reference 13
2,3,4,7,8-PeCDF	57117314	2.02E-08	Reference 13
2,3,7,8-TCDD	1746016	2.30E-09	Reference 13
2,3,7,8-TCDF	51207319	1.40E-08	Reference 13
Cumene	98828	1.33E-02	Reference 12
Dibenzofuran	132649	6.75E-03	Reference 12
Ethyl Benzene	100414	4.80E-02	Reference 12
OCDD	3268879	1.33E-06	Reference 13
OCDF	39001020	2.05E-08	Reference 13
Phenol	108952	1.15E-01	Reference 12
Styrene	100425	1.02E-01	Reference 12

8.21 Open Burning: Yard Waste

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Open burning of yard waste is the purposeful burning of leaf and brush species in outdoor areas. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates for leaf and brush waste burning are a function of the amount of waste burned per year.

For this source category, the following SCCs were assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2610000100	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste – Leaf Species Unspecified
2610000400	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste – Brush Species Unspecified

b. Activity Data

The amount of leaf and brush waste burned was estimated using data from EPA's report *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010.*[1,2] The report presents the total mass of waste generated from the residential and commercial sectors, including yard waste, in the United States by type of waste for the calendar year 2010. According to the EPA report, residential waste generation accounts for 55-65 percent of the total waste from the residential and commercial sectors.[3] For the calculation of per capita yard waste subject to burning, the median value of 60 percent was assumed. This information was used to calculate a daily estimate of the per capita yard waste of 0.36 lbs/person/day. Of the total amount of yard waste generated, the yard waste composition was assumed to be 25 percent leaves, 25 percent brush, and 50 percent grass by weight.[4]

Open burning of grass clippings is not typically practiced by homeowners, and as such only estimates for leaf burning and brush burning were developed. Approximately 25 to 32 percent of all waste that is subject to open burning is actually burned.[4] A median value of 28 percent is assumed to be burned in all counties in the United States.

The per capita estimate was then multiplied by the 2010 population in each county that is expected to burn waste. Since open burning is generally not practiced in urban areas, only the rural population of each county was assumed to practice open burning. The ratio of urban to rural population was obtained from 2010 U.S. Census data.[5] This ratio was then multiplied by the 2010 U.S. Census Bureau estimate of the population in each county to obtain the county-level rural population for 2010.[6]

The percentage of forested acres from Version 2 of BELD2 within BEIS was used to adjust for variations in vegetation. The percentage of forested acres per county (including rural forest and urban forest) was then determined. To better account for the native vegetation that would likely be occurring in the residential yards of farming States, agricultural land acreage was subtracted before calculating the percentage of forested acres. The table below presents the ranges that were used to make adjustments to the amount of yard waste that is assumed to be generated per county. All municipios in Puerto Rico and counties in the U.S. Virgin Islands, Hawaii, and Alaska were assumed to have greater than 50 percent forested acres.

Adjustment for Percentage of Forested Acres

Percent Forested Acres per County	Adjustment for Yard Waste Generated
< 10%	0% generated
>= 10%, and < 50%	50% generated
>= 50%	100% generated

c. Controls

Controls for yard waste burning are generally in the form of a ban on open burning of waste in a given municipality or county. Counties that were more than 80% urban were assumed not to practice any open burning. Therefore, criteria pollutant and HAP emissions from residential yard waste burning are zero in these counties. In addition, the State of Colorado implemented a state-wide ban on open burning. Emissions from open burning of residential yard waste in all Colorado counties were assumed to be zero.

d. Emission Factors

Emission factors are specific to yard waste type and are reported in the corresponding tables below. Emission factors for CAPs were developed by the U.S. Environmental Protection Agency (EPA) in consultation with the Eastern Regional Technical Advisory Committee.[7] For leaf burning, emission factors for $PM_{2.5}$ were calculated by multiplying the PM_{10} leaf burning emission factors by the $PM_{2.5}$ to PM_{10} emission factor ratio for brush burning (0.7709). Emission factors for HAPs are from an EPA Control Technology Center report.[8] Forest fire simulation emission factors were used to estimate emissions for 17 dioxin congeners.[9]

e. Emissions

County-level criteria pollutant and HAP emissions were calculated by multiplying the total amount of yard waste (either leaf or brush) burned per year by an emission factor. Emissions for leaves and residential brush were calculated separately, since emission factors vary by yard waste type.

f. Example Calculations

VOC emissions in Autauga County, Alabama from open burning of leaf waste:

Population of Autauga County in 2010 = 54,571

Rural fraction of Autauga County population = 0.42

Per capita waste yard waste generated (lb/person/day) = 0.3557

Leaf fraction of waste = 0.25

Fraction of rural population that burns yard waste = 0.28

Adjustment factor based on % forested acres = 1

Number of days in a year = 365

Factor to convert from lbs to tons = 1/2000

2010 leaf burning activity in Autauga County = 54,571 * 0.42 * 0.3557 * 0.25 * 0.28 * 1 * 365 * 1/2000

2010 leaf burning activity in Autauga County = 104.15 tons

VOC emissions = tons of leaves burned * VOC emission factor

VOC emission factor = 28 lb/ton

VOC emissions from leaf burning in Autauga County in 2010 = 104.15 tons * 28 lbs/ton * 1 ton/2000 lbs

VOC emissions from leaf burning in Autauga County in 2010 = 1.46 tons

g. QA/QC

1. Methodology: Appears to be adequate and accurate.
    a. Paragraph b. 1 - all of the referenced material confirmed and matches, except for the last sentence about the composition of yard waste consisting of 25% leaves, 25% brush, and 50% grass – this info is referenced in a book, which cannot be obtained electronically(same as 2008). One change from 2008 is the addition of sentences 3 and 4, which assumes 60% of all residential and commercial waste is yard waste subject to burning. Still seems high, but this was not factored at all in 2008. This additional factor results in reducing the total VOC emissions by approximately 40%.
    b. Paragraph b. 2 - Removed grass clipping burning factor since no one burns their grass clippings (same as 2008).

c. Paragraph b. 3 – Removed urban population factor since urban areas generally do not allow open burning. Paragraph c. - Counties that are more than 80% urban are assumed to have NO residential open burning.
d. Paragraph b. 4 – Agricultural/non-forested acres was removed from equation – some places just don't have many trees.
e. Paragraph d. – $PM_{2.5}$ emission factor change is explained. The 2008 emission factor was 22. It is now 16.96.
f. References – a little different than in 2008 – nothing significant.
g. Tables of emission factors for pollutants – everything here is the same as 2008 except:
    i. Methyl Ethyl Ketone was removed from the current list/table
    ii. The emission factor for $PM_{2.5}$ FIL and PRI changed from 22 in 2008 to 16.96 in 2011.

2. Data and Calcs: I checked the math for the counties of Adair, Franklin, Gasconade, Jefferson, Lincoln, and Montgomery for the pollutants of PM_{10} primary, NO_x, and VOC. I didn't find any mistakes – only discrepancies from inconsistent use of significant figures (EPA uses 2-4 sig figs – I always used 2 and the end result always came out very close – only varied by a hundredth or thousandth).
3. Overall: Appears everything is accurate in this document and the associated data. I compared this 2011 document to DNR's 2008 version and everything matches except for the items added, which are in red above. I have a marked up hard copy of this document compared to the 2008 version in case you would like to visually see the differences.

h. References

1. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 1. Materials Generated in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

2. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, "Table 2. Materials Recovered in the Municipal Waste Stream, 1960 to 2010," December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf (accessed April 2012).

3. U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010—Fact Sheet*," p. 4,December 2011, available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf (accessed April 2012).

4. Two Rivers Regional Council of Public Officials and Patrick Engineering, Inc. "Emission Characteristics of Burn Barrels," prepared for the U.S. Environmental Protection Agency, Region V. June 1994.

5. U.S. Census Bureau, Decennial Censuses, 2010 Census: SF1, Table P2

6. U.S. Census Bureau. *Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2011 (NST-EST2011-01),* available at http://www.census.gov/popest/data/national/totals/2011/index.html (accessed April 2012).

7. Huntley, Roy, U.S. Environmental Protection Agency, "state_comparison ERTAC SS_version7_3 Oct 20 2009 [electronic file]," November 5, 2009.

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Emission Factors for Open Burning of Leaf Species (SCC 2610000100)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
1,2,3,4,6,7,8-heptachlorodibenzofuran	67562394	5.08E-08	Reference 9
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	35822469	3.32E-07	Reference 9
1,2,3,4,7,8,9-heptachlorodibenzofuran	55673897	6.12E-09	Reference 9
1,2,3,4,7,8-hexachlorodibenzofuran	70648269	3.34E-08	Reference 9
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227286	1.136E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzofuran	57117449	1.428E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653857	2.14E-08	Reference 9
1,2,3,7,8,9-hexachlorodibenzofuran	72918219	2.22E-09	Reference 9
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408743	3.46E-08	Reference 9
1,2,3,7,8-pentachlorodibenzofuran	57117416	1.268E-06	Reference 9
1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321764	7.66E-09	Reference 9
2,3,4,6,7,8-hexachlorodibenzofuran	60851345	1.962E-08	Reference 9
2,3,4,7,8-pentachlorodibenzofuran	57117314	2.02E-08	Reference 9
2,3,7,8-tetrachlorodibenzofuran	51207319	1.396E-08	Reference 9
2,3,7,8-tetrachlorodibenzo-p-dioxin	1746016	2.3E-09	Reference 9
CO	CO	112	Reference 7
Cumene	98828	0.01325	Reference 8
Ethyl Benzene	100414	0.048	Reference 8
Nitrogen Oxides	NO_X	6.2	Reference 7
Octachlorodibenzofuran	39001020	2.06E-08	Reference 9
Octachlorodibenzo-p-dioxin	3268879	1.328E-06	Reference 9
Phenol	108952	0.115	Reference 8
PM_{10}-FIL	PM_{10}-FIL	22	Reference 7
PM_{10}-PRI	PM_{10}-PRI	22	Reference 7
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	16.96	0.7709 * PM_{10}
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	16.96	0.7709 * PM_{10}
Styrene	100425	0.1015	Reference 8
Sulfur Dioxide	SO_2	0.76	Reference 7
VOC	VOC	28	Reference 7

Emission Factors for Open Burning of Brush Species (SCC 2610000400)

Pollutant	Pollutant Code	Emission Factor (lb/ton)	Emission Factor Reference
CO	CO	140	Reference 7
Nitrogen Oxides	NOX	5	Reference 7
PM_{10}-PRI	PM_{10}-PRI	19.73	Reference 7
PM_{10}-FIL	PM_{10}-FIL	19.73	Reference 7
$PM_{2.5}$-PRI	$PM_{2.5}$-PRI	15.21	Reference 7
$PM_{2.5}$-FIL	$PM_{2.5}$-FIL	15.21	Reference 7
Sulfur Dioxide	SO_2	1.66	Reference 7
VOC	VOC	19	Reference 7
1,2,3,4,6,7,8-heptachlorodibenzofuran	35822469	3.32E-07	Reference 9
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	67562394	5.08E-08	Reference 9
1,2,3,4,7,8,9-heptachlorodibenzofuran	55673897	6.12E-09	Reference 9
1,2,3,4,7,8-hexachlorodibenzofuran	70648269	3.34E-08	Reference 9
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	39227286	1.136E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzofuran	57117449	1.428E-08	Reference 9
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	57653857	2.14E-08	Reference 9
1,2,3,7,8,9-hexachlorodibenzofuran	72918219	2.22E-09	Reference 9
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	19408743	3.46E-08	Reference 9
1,2,3,7,8-pentachlorodibenzofuran	57117416	1.268E-06	Reference 9
1,2,3,7,8-pentachlorodibenzo-p-dioxin	40321764	7.66E-09	Reference 9
2,3,4,6,7,8-hexachlorodibenzofuran	60851345	1.962E-08	Reference 9
2,3,4,7,8-pentachlorodibenzofuran	57117314	2.02E-08	Reference 9
2,3,7,8-tetrachlorodibenzofuran	51207319	1.396E-08	Reference 9
2,3,7,8-tetrachlorodibenzo-p-dioxin	1746016	2.3E-09	Reference 9
Cumene	98828	0.01325	Reference 8
Ethyl Benzene	100414	0.048	Reference 8
Octachlorodibenzofuran	39001020	2.06E-08	Reference 9
Octachlorodibenzo-p-dioxin	3268879	1.328E-06	Reference 9
Phenol	108952	0.115	Reference 8
Styrene	100425	0.1015	Reference 8

8.22 Portable Fuel Containers, Residential and Commercial

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

8.22.1 Portable Fuel Containers (PFC) emission inventories

As part of the MSAT rule, emissions for portable fuel containers (PFC) would be processed in EMS-HAP, ASPEN, and subsequent HAPEM exposure modeling. In order to create the emissions inventories for the MSAT HAPs, two main steps were taken. First, state level VOC PFC emissions were allocated to counties and to several SCC codes. Secondly, after allocation of the VOC emissions, HAP specific emissions were developed. This section describes the processes in both steps.

8.22.1.1 VOC allocation

VOC total PFC reference (uncontrolled) emissions were available for 1990, 2005, 2010, 2015, 2020, and 2030 by state. In addition to the reference inventories, there were control emissions for 2010, 2015, 2020, and 2030. In addition to the years listed, a 1999 reference inventory was needed. The 1999 inventory would be created based on linear interpolation between the 1990 and 2005 inventories.

For both the reference and control inventories, the state VOC emissions needed to be allocated to counties and to SCC codes related to PFC emissions. The following steps were used to allocate the VOC emissions:

- For each year, the reference inventories were read into SAS®. For 2010, 2015, 2020, and 2030, the control inventories were read into SAS®.
- The state level VOC emissions for each year and emissions scenario, reference or control, were allocated to residential and commercial components for six categories: 1) vapor displacement while refilling containers at the pump, 2) spillage while refilling at the pump, 3) spillage during transport, 4) vapor displacement while refueling equipment, 5) spillage while refueling equipment, and 6) permeation and evaporation. Total state level PFC emissions were allocated

to the categories by using national level residential and commercial emissions for each of the categories using the following equations:

$$E_{residential,XXXX,YY} = E \times \left(\frac{\mathrm{Re}\,s}{\mathrm{Re}\,s + Com} \right) \quad (9)$$

$$E_{commercial,XXXX,YY} = E \times \left(\frac{Com}{\mathrm{Re}\,s + Com} \right) \quad (10)$$

where E was the emissions of the category being split, XXXX was year, YY was state, and Res and Com were the emissions shown in the corresponding table below.

- After allocating the VOC emissions to the six categories, the commercial and residential permeation and evaporation categories were split into commercial permeation, commercial evaporation, residential permeation, and residential evaporation by

$$E_{AAA,XXXX,YY,perm} = E_{AAA,XXXX,YY,perm\&evap} \times 0.3387 \quad (11)$$

$$E_{AAA,XXXX,YY,evap} = E_{AAA,XXXX,YY,perm\&evap} \times (1 - 0.3387) \quad (12)$$

The fraction 0.3387 represents the fraction of combined permeation and evaporative emissions attributable to permeation, based on data from the California Air Resources Board.

- Once the state VOC emissions were allocated to the residential and commercial components of the categories, they were assigned SCC codes for later processing in EMS-HAP. These codes are shown in the corresponding table below.

  .

- After creating the SCC level state emissions for the years and emission scenarios, a 1999 reference inventory was created by interpolating from the 1990 to 2005 emissions. The interpolation was done for each state and SCC combination and the equation was:

$$E_{1999,YY,SCC} = E_{1990,YY,SCC} + \left(9 \times \left(\frac{E_{2005,YY,SCC} - E_{1990,YY,SCC}}{15}\right)\right) \quad (13)$$

where $E_{1999,YY,SCC}$, $E_{1990,YYY,SCC}$, and $E_{2005,YY,SCC}$ were the 1999, 1990, and 2005 emissions for state YY and SCC shown in the corresponding table below.

- After creating the 1999 state VOC inventory, the state emissions were allocated to the counties by using the ratio of county to state fuel consumption. State emissions were multiplied by the county specific ratio to yield a county specific VOC emissions number for each SCC. This equation is shown as Equation 14.

$$E_{XXXX,YYYYY,AAA,SCC} = E_{XXXX,YY,AAA,SCC} \times \left(\frac{Consumption_{YYYYY}}{Consumption_{YY}}\right) \quad (14)$$

where $E_{XXXX,YYYYY,AAA,SCC}$ were the emissions for year XXXX, county with FIPS code YYYYY, emission scenario AAA (reference or control) and SCC shown in the corresponding table below, $E_{XXXX,YY,AAA,SCC}$ were the state level emissions for year XXXX, state YY, emission scenario AAA, and SCC in the corresponding table below, $Consumption_{YYYY}$ was the county fuel consumption and $Consumption_{YY}$ was the state fuel consumption.

- As for the nonroad emissions, Broomfield County emissions were allocated to surrounding counties.

Figure 9 shows the flow of steps for allocation of VOC emissions.

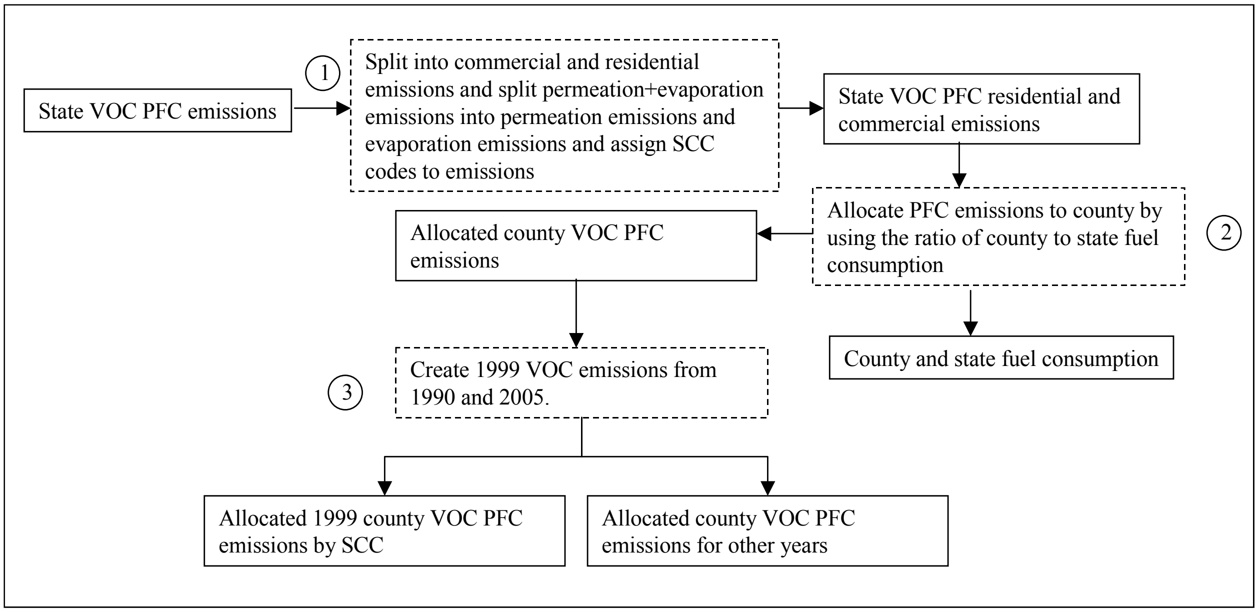


Figure: Steps in allocation of state VOC PFC emissions to counties.

PFC categories with national level residential and commercial emissions

Category	Residential Emissions	Commercial Emissions
Vapor displacement while refilling at the pump	4,328	8,341
Spillage displacement while refilling at the pump	382	735
Spillage during transport	13,519	18,442
Vapor displacement while refueling equipment	4,328	8,341
Spillage while refueling equipment	21,340	41,747
Permeation and evaporation	187,757	5,997

SCC codes of PFC categories

SCC code	Description
2501011011	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Permeation
2501011012	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Evaporation
2501011013	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Spillage During Transport
2501011014	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refilling at the Pump - Vapor Displacement
2501011015	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refilling at the Pump - Spillage

2501011016	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refueling Equipment - Vapor Displacement
2501011017	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refueling Equipment - Spillage
2501012011	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Permeation
2501012012	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Evaporation
2501012013	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Spillage During Transport
2501012014	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refilling at the Pump - Vapor Displacement
2501012015	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refilling at the Pump - Spillage
2501012016	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refueling Equipment - Vapor Displacement
2501012017	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refueling Equipment - Spillage

8.22.1.2 Creation of HAP PFC inventories

Once the state VOC PFC emissions were allocated to counties and SCC codes, PFC emissions for MSAT HAPs could be developed. Two methods were used to create the emissions, one for benzene, and the second for other HAPs. For benzene, the county level light duty gasoline vehicle (LDGV) refueling emissions for benzene and VOC were used to create the PFC emissions. At the county level, the benzene refueling emissions were divided by the VOC refueling emissions, to yield a ratio that would be multiplied with the PFC VOC emissions. Benzene fuel control refueling emissions would be used for refueling control emissions while no fuel controls would be used for 1999 and all the future year reference inventories. Several combinations of PFC and benzene fuel control refueling ratios would be used. These combinations were composed of the PFC emissions with no controls, and with controls, and with benzene refueling emissions with and without controls. The corresponding table below lists the combinations and years for which they were used.

PFC and benzene fuel control inventory scenarios

PFC emissions	Benzene refueling emissions	Years
No controls	No controls	1999, 2010, 2015, 2020, 2030
Controls	Controls	2015, 2020, 2030
No controls	Controls	2015, 2020, 2030
Controls	No controls	2010, 2015, 2020, 2030

To calculate the benzene emissions for each PFC SCC in each county the following formulas were used. For all SCC emissions except for permeation (residential and commercial) the benzene emissions were calculated as:

$$Benzene_{AAA,XXXX,YYYYY,SCC} = VOC_{AAA,XXXX,YYYYY,SCC} \times \left(\frac{Benzene_{refuel,XXXX,YYYYY,BBB}}{VOC_{refuel,XXXX,YYYYY,BBB}} \right) \times 0.36 \tag{15}$$

For permeation emissions, the equation was

$$Benzene_{AAA,XXXX,YYYYY,SCC} = VOC_{AAA,XXXX,YYYYY,SCC} \times \left(\frac{Benzene_{refuel,XXXX,YYYYY,BBB}}{VOC_{refuel,XXXX,YYYYY,BBB}} \right) \times 0.36 \times 1.77 \tag{16}$$

where XXXX was the year, YYYYY was the FIPS code of the county, and SCC was an SCC code shown in the corresponding table. AAA represents no controls or controls for PFC emissions, and BBB represents whether refueling emissions are control or uncontrolled. Note that 1999 and 2010 uncontrolled benzene refueling emissions were calculated from 2015 as done in the onroad emissions processing.

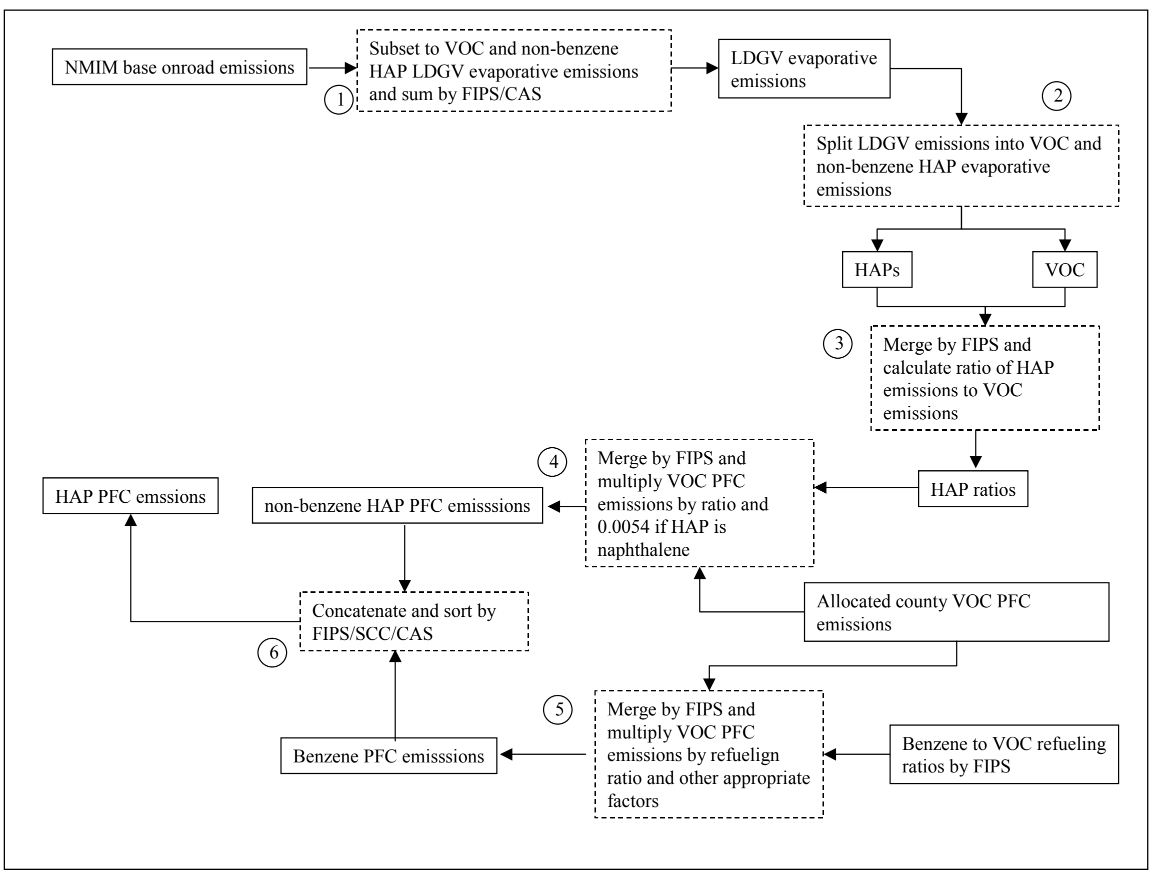
In the equations the factor 0.36 represents an adjustment based on the nationwide percentage of benzene in gasoline vapor from gasoline distribution with an RVP of 10 psi at 60˚F (Hester, 2006). The percentage is 0.27%, in contrast to 0.74% benzene in vehicle refueling emissions from highway vehicles. The ratio or factor of 0.36 was applied to the refueling emissions. A second ratio was used for permeation emissions since recent research suggests that the ratio of benzene from permeation is higher than for evaporation, vapor displacement or spillage. A recent study (Haskew et al., 2004) suggests that the ratio of benzene from permeation to total VOC from permeation is about 1.7727 times higher than the ratio associated with evaporation.

For all other HAPs, the PFC emissions were created by multiplying the PFC VOC emissions by the county level ratio of HAP LDGV evaporative emissions by the VOC LDGV evaporative emissions for the county or:

$$HAP_{AAA,XXXX,YYYYY,SCC} = VOC_{AAA,XXXX,YYYYY,SCC} \times \left(\frac{HAP_{LDGV,XXXX,YYYYY}}{VOC_{LDGV,XXXX,YYYYY}} \right) \tag{17}$$

where the subscripts are as denoted previously. Using the LDGV evaporative emissions means only HAPs in the onroad inventory with LDGV evaporative emissions would have PFC emissions. For all other HAPs, the same formula was used for all SCC codes. Naphthalene was also multiplied by a factor of 0.0054 to reduce the emissions. The corresponding tables below list the emissions summaries for the no controls inventories the emissions summaries for the controlled inventories, respectively. Steps used in creating the HAP inventories are shown in the figure below.

Figure: Steps in creating HAP PFC emissions



PFC emissions with and without controls for units without benzene fuel controls

PFC type	HAP	Year								
		1999	2010		2015		2020		2030	
		PFC: no controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls
Commercial PFC: Evaporation	Benzene	9.30×10^{0}	9.03×10^{0}	8.62×10^{0}	9.55×10^{0}	7.72×10^{-1}	1.02×10^{1}	8.24×10^{-1}	1.15×10^{1}	9.33×10^{-1}
	All HAPs	4.61×10^{2}	3.92×10^{2}	3.71×10^{2}	4.13×10^{2}	3.93×10^{1}	4.37×10^{2}	4.14×10^{1}	4.92×10^{2}	4.65×10^{1}
Commercial PFC: Permeation	Benzene	8.43×10^{0}	8.18×10^{0}	7.82×10^{0}	8.66×10^{0}	7.00×10^{-1}	9.25×10^{0}	7.47×10^{-1}	1.05×10^{1}	8.46×10^{-1}
	All HAPs	2.40×10^{2}	2.04×10^{2}	1.94×10^{2}	2.15×10^{2}	2.04×10^{1}	2.28×10^{2}	2.15×10^{1}	2.57×10^{2}	2.42×10^{1}
Commercial PFC: Refilling at the Pump: Spillage	Benzene	1.61×10^{0}	1.80×10^{0}	1.80×10^{0}	1.96×10^{0}	1.96×10^{0}	2.12×10^{0}	2.12×10^{0}	2.45×10^{0}	2.45×10^{0}
	All HAPs	8.42×10^{1}	8.73×10^{1}	8.73×10^{1}	9.44×10^{1}	9.44×10^{1}	1.01×10^{2}	1.01×10^{2}	1.16×10^{2}	1.16×10^{2}
Commercial PFC: Refilling at the Pump: Vapor Displacement	Benzene	1.83×10^{1}	2.05×10^{1}	2.05×10^{1}	2.23×10^{1}	2.23×10^{1}	2.41×10^{1}	2.41×10^{1}	2.79×10^{1}	2.79×10^{1}
	All HAPs	9.57×10^{2}	9.90×10^{2}	9.90×10^{2}	1.07×10^{3}	1.07×10^{3}	1.14×10^{3}	1.14×10^{3}	1.31×10^{3}	1.31×10^{3}
Commercial PFC: Refueling Equipment: Spillage	Benzene	1.00×10^{2}	8.95×10^{1}	5.30×10^{1}	9.66×10^{1}	5.72×10^{1}	1.05×10^{2}	6.20×10^{1}	1.21×10^{2}	7.16×10^{1}
	All HAPs	5.17×10^{3}	4.09×10^{3}	2.58×10^{3}	4.40×10^{3}	2.78×10^{3}	4.72×10^{3}	2.97×10^{3}	5.41×10^{3}	3.41×10^{3}
Commercial PFC: Refueling Equipment: Vapor Displacement	Benzene	1.83×10^{1}	2.05×10^{1}	2.05×10^{1}	2.23×10^{1}	2.23×10^{1}	2.41×10^{1}	2.41×10^{1}	2.79×10^{1}	2.79×10^{1}
	All HAPs	9.57×10^{2}	9.90×10^{2}	9.90×10^{2}	1.07×10^{3}	1.07×10^{3}	1.14×10^{3}	1.14×10^{3}	1.31×10^{3}	1.31×10^{3}
Commercial PFC: Spillage During Transport	Benzene	4.10×10^{1}	4.44×10^{1}	4.35×10^{1}	4.81×10^{1}	4.29×10^{1}	5.20×10^{1}	4.64×10^{1}	5.99×10^{1}	5.34×10^{1}
	All HAPs	2.12×10^{3}	2.11×10^{3}	2.07×10^{3}	2.28×10^{3}	2.06×10^{3}	2.43×10^{3}	2.20×10^{3}	2.78×10^{3}	2.52×10^{3}
Residential PFC: Evaporation	Benzene	2.91×10^{2}	2.83×10^{2}	2.70×10^{2}	2.99×10^{2}	2.42×10^{1}	3.19×10^{2}	2.58×10^{1}	3.62×10^{2}	2.92×10^{1}
	All HAPs	1.44×10^{4}	1.23×10^{4}	1.16×10^{4}	1.29×10^{4}	1.23×10^{3}	1.37×10^{4}	1.30×10^{3}	1.54×10^{4}	1.46×10^{3}
Residential PFC:	Benzene	2.64×10^{2}	2.56×10^{2}	2.45×10^{2}	2.71×10^{2}	2.19×10^{1}	2.90×10^{2}	2.34×10^{1}	3.28×10^{2}	2.65×10^{1}

PFC type	HAP	Year								
		1999	2010		2015		2020		2030	
		PFC: no controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls
Permeation	All HAPs	$7.50x10^{3}$	$6.39x10^{3}$	$6.06x10^{3}$	$6.75x10^{3}$	$6.40x10^{2}$	$7.14x10^{3}$	$6.75x10^{2}$	$8.04x10^{3}$	$7.58x10^{2}$
Residential PFC: Refilling at the Pump: Spillage	Benzene	$8.37x10^{-1}$	$9.37x10^{-1}$	$9.37x10^{-1}$	$1.02x10^{0}$	$1.02x10^{0}$	$1.10x10^{0}$	$1.10x10^{0}$	$1.27x10^{0}$	$1.27x10^{0}$
	All HAPs	$4.38x10^{1}$	$4.54x10^{1}$	$4.54x10^{1}$	$4.91x10^{1}$	$4.91x10^{1}$	$5.25x10^{1}$	$5.25x10^{1}$	$6.02x10^{1}$	$6.02x10^{1}$
Residential PFC: Refilling at the Pump: Vapor Displacement	Benzene	$9.51x10^{0}$	$1.07x10^{1}$	$1.07x10^{1}$	$1.16x10^{1}$	$1.16x10^{1}$	$1.25x10^{1}$	$1.25x10^{1}$	$1.45x10^{1}$	$1.45x10^{1}$
	All HAPs	$4.97x10^{2}$	$5.14x10^{2}$	$5.14x10^{2}$	$5.55x10^{2}$	$5.55x10^{2}$	$5.94x10^{2}$	$5.94x10^{2}$	$6.82x10^{2}$	$6.82x10^{2}$
Residential PFC: Refueling Equipment: Spillage	Benzene	$5.11x10^{1}$	$4.57x10^{1}$	$2.71x10^{1}$	$4.94x10^{1}$	$2.93x10^{1}$	$5.35x10^{1}$	$3.17x10^{1}$	$6.18x10^{1}$	$3.66x10^{1}$
	All HAPs	$2.64x10^{3}$	$2.09x10^{3}$	$1.32x10^{3}$	$2.25x10^{3}$	$1.42x10^{3}$	$2.41x10^{3}$	$1.52x10^{3}$	$2.77x10^{3}$	$1.74x10^{3}$
Residential PFC: Refueling Equipment: Vapor Displacement	Benzene	$9.51x10^{0}$	$1.07x10^{1}$	$1.07x10^{1}$	$1.16x10^{1}$	$1.16x10^{1}$	$1.25x10^{1}$	$1.25x10^{1}$	$1.45x10^{1}$	$1.45x10^{1}$
	All HAPs	$4.97x10^{2}$	$5.14x10^{2}$	$5.14x10^{2}$	$5.55x10^{2}$	$5.55x10^{2}$	$5.94x10^{2}$	$5.94x10^{2}$	$6.82x10^{2}$	$6.82x10^{2}$
Residential PFC: Spillage During Transport	Benzene	$3.00x10^{1}$	$3.26x10^{1}$	$3.19x10^{1}$	$3.53x10^{1}$	$3.15x10^{1}$	$3.81x10^{1}$	$3.40x10^{1}$	$4.39x10^{1}$	$3.92x10^{1}$
	All HAPs	$1.56x10^{3}$	$1.55x10^{3}$	$1.52x10^{3}$	$1.67x10^{3}$	$1.51x10^{3}$	$1.78x10^{3}$	$1.62x10^{3}$	$2.04x10^{3}$	$1.85x10^{3}$

PFC emissions with and without controls for units with benzene fuel controls

PFC type	HAP	Year					
		2015		2020		2030	
		PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls	PFC: no controls	PFC: with controls
Commercial PFC: Evaporation	Benzene	5.79×10^{0}	5.05×10^{-1}	6.19×10^{0}	5.39×10^{-1}	7.00×10^{0}	6.10×10^{-1}
	All HAPs	4.10×10^{2}	3.91×10^{1}	4.33×10^{2}	4.12×10^{1}	4.88×10^{2}	4.62×10^{1}
Commercial PFC: Permeation	Benzene	5.25×10^{0}	4.58×10^{-1}	5.61×10^{0}	4.89×10^{-1}	6.35×10^{0}	5.53×10^{-1}
	All HAPs	2.12×10^{2}	2.02×10^{1}	2.24×10^{2}	2.13×10^{1}	2.53×10^{2}	2.39×10^{1}
Commercial PFC: Refilling at the Pump: Spillage	Benzene	1.25×10^{0}	1.25×10^{0}	1.35×10^{0}	1.35×10^{0}	1.56×10^{0}	1.56×10^{0}
	All HAPs	9.37×10^{1}	9.37×10^{1}	1.00×10^{2}	1.00×10^{2}	1.15×10^{2}	1.15×10^{2}
Commercial PFC: Refilling at the Pump: Vapor Displacement	Benzene	1.42×10^{1}	1.42×10^{1}	1.54×10^{1}	1.54×10^{1}	1.77×10^{1}	1.77×10^{1}
	All HAPs	1.06×10^{3}	1.06×10^{3}	1.14×10^{3}	1.14×10^{3}	1.30×10^{3}	1.30×10^{3}
Commercial PFC: Refueling Equipment: Spillage	Benzene	6.02×10^{1}	3.66×10^{1}	6.52×10^{1}	3.97×10^{1}	7.53×10^{1}	4.58×10^{1}
	All HAPs	4.36×10^{3}	2.76×10^{3}	4.68×10^{3}	2.95×10^{3}	5.37×10^{3}	3.38×10^{3}
Commercial PFC: Refueling Equipment: Vapor Displacement	Benzene	1.42×10^{1}	1.42×10^{1}	1.54×10^{1}	1.54×10^{1}	1.77×10^{1}	1.77×10^{1}
	All HAPs	1.06×10^{3}	1.06×10^{3}	1.14×10^{3}	1.14×10^{3}	1.30×10^{3}	1.30×10^{3}
Commercial PFC: Spillage During Transport	Benzene	3.05×10^{1}	2.74×10^{1}	3.30×10^{1}	2.96×10^{1}	3.80×10^{1}	3.41×10^{1}
	All HAPs	2.26×10^{3}	2.05×10^{3}	2.41×10^{3}	2.19×10^{3}	2.76×10^{3}	2.50×10^{3}
Residential PFC: Evaporation	Benzene	1.81×10^{2}	1.58×10^{1}	1.94×10^{2}	1.69×10^{1}	2.19×10^{2}	1.91×10^{1}
	All HAPs	1.28×10^{4}	1.22×10^{3}	1.36×10^{4}	1.29×10^{3}	1.53×10^{4}	1.45×10^{3}
Residential PFC: Permeation	Benzene	1.64×10^{2}	1.43×10^{1}	1.76×10^{2}	1.53×10^{1}	1.99×10^{2}	1.73×10^{1}
	All HAPs	6.64×10^{3}	6.33×10^{2}	7.02×10^{3}	6.67×10^{2}	7.91×10^{3}	7.49×10^{2}
Residential PFC: Refilling at the Pump: Spillage	Benzene	6.50×10^{-1}	6.50×10^{-1}	7.03×10^{-1}	7.03×10^{-1}	8.13×10^{-1}	8.13×10^{-1}
	All HAPs	4.87×10^{1}	4.87×10^{1}	5.21×10^{1}	5.21×10^{1}	5.97×10^{1}	5.97×10^{1}
Residential PFC: Refilling at the Pump: Vapor Displacement	Benzene	7.36×10^{0}	7.36×10^{0}	7.97×10^{0}	7.97×10^{0}	9.20×10^{0}	9.20×10^{0}
	All HAPs	5.51×10^{2}	5.51×10^{2}	5.90×10^{2}	5.90×10^{2}	6.76×10^{2}	6.76×10^{2}
Residential PFC: Refueling Equipment: Spillage	Benzene	3.08×10^{1}	1.87×10^{1}	3.33×10^{1}	2.03×10^{1}	3.85×10^{1}	2.34×10^{1}
	All HAPs	2.23×10^{3}	1.41×10^{3}	2.39×10^{3}	1.51×10^{3}	2.74×10^{3}	1.73×10^{3}
Residential PFC: Refueling Equipment: Vapor Displacement	Benzene	7.36×10^{0}	7.36×10^{0}	7.97×10^{0}	7.97×10^{0}	9.20×10^{0}	9.20×10^{0}
	All HAPs	5.51×10^{2}	5.51×10^{2}	5.90×10^{2}	5.90×10^{2}	6.76×10^{2}	6.76×10^{2}
Residential PFC: Spillage During Transport	Benzene	2.24×10^{1}	2.01×10^{1}	2.42×10^{1}	2.17×10^{1}	2.78×10^{1}	2.50×10^{1}
	All HAPs	1.66×10^{3}	1.50×10^{3}	1.77×10^{3}	1.60×10^{3}	2.02×10^{3}	1.83×10^{3}

8.23 Residential wood combustion

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA. Subsection d contains Missouri's audit of EPA's estimate.

a. Source Category Description

Residential wood combustion includes the burning of wood and wax firelogs in home heating appliances. Specifically excluded from this category are residential leaf and brush burning from yard or land clearing activities (see 2610000100 and 2610000400). Appliances are broken down by type (fireplaces, woodstoves, furnaces, and outdoor hydronic heaters), and estimates are based on typical usage profile (main heat, supplemental, pleasure burning).

The following source classification code (SCCs) are used for this category:

List of nonpoint SCC codes

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2104008100	Stationary Source Fuel Combustion	Residential	Wood	Fireplace: general
2104008210	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; non-EPA certified
2104008220	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; non-catalytic
2104008230	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; catalytic
2104008310	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, non-EPA certified
2104008320	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, non-catalytic
2104008330	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, catalytic
2104008400	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: pellet-fired, general
2104008510	Stationary Source Fuel Combustion	Residential	Wood	Furnace: Indoor, cordwood-fired, non-EPA certified
2104008610	Stationary Source Fuel Combustion	Residential	Wood	Hydronic heater: outdoor
2104008700	Stationary Source Fuel Combustion	Residential	Wood	Outdoor wood burning device, NEC
2104009000	Stationary Source Fuel Combustion	Residential	Firelog	Total: All Combustor Types

b. Estimation Method

EPA has created a tool for states to use to estimate residential wood combustion emissions called the Residential Wood Tool (RWC). It is a Microsoft Access database containing the tables and queries needed by states to update emission estimates. The estimation method is based on the following equation:

(Number of appliances) * (Emission factor) * (Cords of wood burned per appliance) * (Wood Density) = Emissions

c. Activity Data

The activity data in the estimation equation includes the number of appliances, and cords of wood burned.

The number of appliances is estimated from US Census American Housing Survey Metropolitan Survey data estimating the number of occupied households in each county, the type of heating appliances, and their usage. These surveys were mainly done in the late 1990s to mid 2000s, with some state-specific survey data from the late 2000s to update their appliance types. The “appliance profile” table in the tool summarizes the percentage of housing units with that appliance type that burn wood. Missouri’s appliance profiles are 2, 26, and 51.

Burn profiles are used to estimate the amount of wood burned per appliance type. Much of this data are national averages by climate region, with a few geographic specific surveys as well. West Virginia, Wisconsin, Vermont, and Minnesota have done surveys to update their burn profiles. For national defaults, the source of data is cited as “Burn rates are an average of what was discovered in the literature regarding burn rates. For more detail, see file entitled "Burn rate data.xls". Report years are from 1992 to 2002”. This excel file is not made available with the RWC tool, and it has not been reviewed by Missouri.

Emission factors are discussed in section c.

Density of wood is estimated for each county based on the 2005 Timber Products Output (TPO) Fuel wood consumption. The reference within the tool states, “Density by county computed by taking volume of wood reported by species in the TPO, then multiplying by a species density factor provided by the US Forest service. Total mass for a county is then divided by total volume for a county to get average density for a county.
Counties not reporting to the TPO were filled in using regional averages.” Missouri densities are between 1ton/cord and 1.5 ton/cord, with a statewide average of 1.39 ton/cord which is the highest in the country (tied with Connecticut). The University of Missouri Extension publication “Wood Fuel For Heating”[1] cites a dry, seasoned weight of hardwood of 3,600 lb/cord, which is 1.8 ton/cord. Their estimate would be for ideal wood types, so the more typical 1.39 ton/cord average is acceptable.

c. Emission Factors

Criteria air pollutant (CAP) emission factors used in the tool are listed by SCC below with a brief reference to their origin. Hazardous air pollutant (HAP) emissions are included in the RWC tool, but are not included here due to length. The tool also estimates the greenhouse gases (GHG) carbon dioxide and methane, but these emission factors are not included here. Final Missouri calculated emissions for CAP, HAP, and GHG are summarized in section e.

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008100	NH_3	Fireplace: general	Ammonia	1.8	lb	ton	MARAMA
2104008210	NH_3	Woodstove: fireplace inserts; non-EPA certified	Ammonia	1.7	lb	ton	MARAMA
2104008220	NH_3	Woodstove: fireplace inserts; EPA certified; non-catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008230	NH_3	Woodstove: fireplace inserts; EPA certified; catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008310	NH_3	Woodstove: freestanding, non-EPA certified	Ammonia	1.7	lb	ton	MARAMA
2104008320	NH_3	Woodstove: freestanding, EPA certified, non-catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008330	NH_3	Woodstove: freestanding, EPA certified, catalytic	Ammonia	0.9	lb	ton	MARAMA
2104008400	NH_3	Woodstove: pellet-fired, general	Ammonia	0.3	lb	ton	MARAMA
2104008510	NH_3	Furnace: Indoor, cordwood-fired, non-EPA certified	Ammonia	1.8	lb	ton	MARAMA

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008610	NH_3	Hydronic heater: outdoor	Ammonia	1.8	lb	ton	From Woodstoves.
2104008700	NH_3	Outdoor wood burning device, NEC	Ammonia	1.8	lb	ton	MARAMA
2104008100	CO	Fireplace: general	Carbon Monoxide	149	lb	ton	MARAMA
2104008210	CO	Woodstove: fireplace inserts; non-EPA certified	Carbon Monoxide	230.8	lb	ton	2002 NEI
2104008220	CO	Woodstove: fireplace inserts; EPA certified; non-catalytic	Carbon Monoxide	140.8	lb	ton	2002 NEI
2104008230	CO	Woodstove: fireplace inserts; EPA certified; catalytic	Carbon Monoxide	104.4	lb	ton	2002 NEI
2104008310	CO	Woodstove: freestanding, non-EPA certified	Carbon Monoxide	230.8	lb	ton	2002 NEI
2104008320	CO	Woodstove: freestanding, EPA certified, non-catalytic	Carbon Monoxide	140.8	lb	ton	2002 NEI
2104008330	CO	Woodstove: freestanding, EPA certified, catalytic	Carbon Monoxide	104.4	lb	ton	2002 NEI
2104008400	CO	Woodstove: pellet-fired, general	Carbon Monoxide	15.9	lb	ton	MARAMA
2104008510	CO	Furnace: Indoor, cordwood-fired, non-EPA certified	Carbon Monoxide	184	lb	ton	MARAMA
2104008610	CO	Hydronic heater: outdoor	Carbon Monoxide	360	lb	ton	From EPA report , 2012, Gullet et al.
2104008700	CO	Outdoor wood burning device, NEC	Carbon Monoxide	149	lb	ton	MARAMA
2104009000	CO	Residential Firelog Total: All Combustor Types	Carbon Monoxide	125.08	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	NO_X	Fireplace: general	Nitrogen Oxides	2.6	lb	ton	2002 NEI
2104008210	NO_X	Woodstove: fireplace inserts; non-EPA certified	Nitrogen Oxides	2.8	lb	ton	2002 NEI
2104008220	NO_X	Woodstove: fireplace inserts; EPA certified; non-catalytic	Nitrogen Oxides	2.28	lb	ton	MARAMA
2104008230	NO_X	Woodstove: fireplace inserts; EPA certified; catalytic	Nitrogen Oxides	2	lb	ton	2002 NEI
2104008310	NO_X	Woodstove: freestanding, non-EPA certified	Nitrogen Oxides	2.8	lb	ton	2002 NEI
2104008320	NO_X	Woodstove: freestanding, EPA certified, non-catalytic	Nitrogen Oxides	2.28	lb	ton	MARAMA
2104008330	NO_X	Woodstove: freestanding, EPA certified, catalytic	Nitrogen Oxides	2	lb	ton	2002 NEI
2104008400	NO_X	Woodstove: pellet-fired, general	Nitrogen Oxides	3.8	lb	ton	MARAMA
2104008510	NO_X	Furnace: Indoor, cordwood-fired, non-EPA certified	Nitrogen Oxides	1.8	lb	ton	MARAMA
2104008610	NO_X	Hydronic heater: outdoor	Nitrogen Oxides	1.8	lb	ton	From Woodstoves.

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008700	NO_X	Outdoor wood burning device, NEC	Nitrogen Oxides	2.6	lb	ton	2002 NEI
2104009000	NO_X	Residential Firelog Total: All Combustor Types	Nitrogen Oxides	7.684	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	PM_{10}-PRI	Fireplace: general	Primary PM_{10}	23.6	lb	ton	2002 NEI
2104008210	PM_{10}-PRI	Woodstove: fireplace inserts; non-EPA certified	Primary PM_{10}	30.6	lb	ton	2002 NEI
2104008220	PM_{10}-PRI	Woodstove: fireplace inserts; EPA certified; non-catalytic	Primary PM_{10}	19.6	lb	ton	2002 NEI
2104008230	PM_{10}-PRI	Woodstove: fireplace inserts; EPA certified; catalytic	Primary PM_{10}	20.4	lb	ton	2002 NEI
2104008310	PM_{10}-PRI	Woodstove: freestanding, non-EPA certified	Primary PM_{10}	30.6	lb	ton	2002 NEI
2104008320	PM_{10}-PRI	Woodstove: freestanding, EPA certified, non-catalytic	Primary PM_{10}	19.6	lb	ton	2002 NEI
2104008330	PM_{10}-PRI	Woodstove: freestanding, EPA certified, catalytic	Primary PM_{10}	20.4	lb	ton	2002 NEI
2104008400	PM_{10}-PRI	Woodstove: pellet-fired, general	Primary PM_{10}	3.06	lb	ton	MARAMA
2104008510	PM_{10}-PRI	Furnace: Indoor, cordwood-fired, non-EPA certified	Primary PM_{10}	27.6	lb	ton	MARAMA
2104008610	PM_{10}-PRI	Hydronic heater: outdoor	Primary PM_{10}	64	lb	ton	From EPA report , 2012, Gullet et al.
2104008700	PM_{10}-PRI	Outdoor wood burning device, NEC	Primary PM_{10}	23.6	lb	ton	2002 NEI
2104009000	PM_{10}-PRI	Residential Firelog Total: All Combustor Types	Primary PM_{10}	29.32	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	$PM_{2.5}$-PRI	Fireplace: general	Primary $PM_{2.5}$	23.6	lb	ton	2002 NEI
2104008210	$PM_{2.5}$-PRI	Woodstove: fireplace inserts; non-EPA certified	Primary $PM_{2.5}$	30.6	lb	ton	2002 NEI
2104008220	$PM_{2.5}$-PRI	Woodstove: fireplace inserts; EPA certified; non-catalytic	Primary $PM_{2.5}$	19.6	lb	ton	2002 NEI
2104008230	$PM_{2.5}$-PRI	Woodstove: fireplace inserts; EPA certified; catalytic	Primary $PM_{2.5}$	20.4	lb	ton	2002 NEI
2104008310	$PM_{2.5}$-PRI	Woodstove: freestanding, non-EPA certified	Primary $PM_{2.5}$	30.6	lb	ton	2002 NEI
2104008320	$PM_{2.5}$-PRI	Woodstove: freestanding, EPA certified, non-catalytic	Primary $PM_{2.5}$	19.6	lb	ton	2002 NEI
2104008330	$PM_{2.5}$-PRI	Woodstove: freestanding, EPA certified, catalytic	Primary $PM_{2.5}$	20.4	lb	ton	2002 NEI
2104008400	$PM_{2.5}$-PRI	Woodstove: pellet-fired, general	Primary $PM_{2.5}$	3.06	lb	ton	MARAMA
2104008510	$PM_{2.5}$-PRI	Furnace: Indoor, cordwood-fired, non-EPA certified	Primary $PM_{2.5}$	27.6	lb	ton	MARAMA
2104008610	$PM_{2.5}$-PRI	Hydronic heater: outdoor	Primary $PM_{2.5}$	64	lb	ton	From EPA report , 2012, Gullet et al.

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104008700	$PM_{2.5}$-PRI	Outdoor wood burning device, NEC	Primary $PM_{2.5}$	23.6	lb	ton	2002 NEI
2104009000	$PM_{2.5}$-PRI	Residential Firelog Total: All Combustor Types	Primary $PM_{2.5}$	28.4	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada
2104008100	SO_2	Fireplace: general	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008210	SO_2	Woodstove: fireplace inserts; non-EPA certified	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008220	SO_2	Woodstove: fireplace inserts; EPA certified; non-catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008230	SO_2	Woodstove: fireplace inserts; EPA certified; catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008310	SO_2	Woodstove: freestanding, non-EPA certified	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008320	SO_2	Woodstove: freestanding, EPA certified, non-catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008330	SO_2	Woodstove: freestanding, EPA certified, catalytic	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008400	SO_2	Woodstove: pellet-fired, general	Sulfur Dioxide	0.32	lb	ton	MARAMA
2104008510	SO_2	Furnace: Indoor, cordwood-fired, non-EPA certified	Sulfur Dioxide	2.03	lb	ton	MARAMA
2104008610	SO_2	Hydronic heater: outdoor	Sulfur Dioxide	2.03	lb	ton	From Woodstoves.
2104008700	SO_2	Outdoor wood burning device, NEC	Sulfur Dioxide	0.4	lb	ton	2002 NEI
2104008100	VOC	Fireplace: general	Volatile Organic Compounds	18.9	lb	ton	MARAMA
2104008210	VOC	Woodstove: fireplace inserts; non-EPA certified	Volatile Organic Compounds	53	lb	ton	2002 NEI
2104008220	VOC	Woodstove: fireplace inserts; EPA certified; non-catalytic	Volatile Organic Compounds	12	lb	ton	2002 NEI
2104008230	VOC	Woodstove: fireplace inserts; EPA certified; catalytic	Volatile Organic Compounds	15	lb	ton	2002 NEI
2104008310	VOC	Woodstove: freestanding, non-EPA certified	Volatile Organic Compounds	53	lb	ton	2002 NEI
2104008320	VOC	Woodstove: freestanding, EPA certified, non-catalytic	Volatile Organic Compounds	12	lb	ton	2002 NEI
2104008330	VOC	Woodstove: freestanding, EPA certified, catalytic	Volatile Organic Compounds	15	lb	ton	2002 NEI
2104008400	VOC	Woodstove: pellet-fired, general	Volatile Organic Compounds	0.041	lb	ton	MARAMA
2104008510	VOC	Furnace: Indoor, cordwood-fired, non-EPA certified	Volatile Organic Compounds	11.7	lb	ton	MARAMA
2104008610	VOC	Hydronic heater: outdoor	Volatile Organic Compounds	67.4	lb	ton	From EPA report , 2012, Gullet et al.
2104008700	VOC	Outdoor wood burning device, NEC	Volatile Organic Compounds	18.9	lb	ton	MARAMA

SCC	Pollutant Code	SCC Level 4	pollutant	Emission Factor	numerator	denominator	data_source
2104009000	VOC	Residential Firelog Total: All Combustor Types	Volatile Organic Compounds	39.56	lb	ton	Content and emission characteristics of Artificial Wax Firelogs, Environment Canada

d. Quality Assurance

The first review was of the number of occupied housing units file EPA used by default. The file contained one extra county for Missouri that is a duplicate – Ste. Genevieve county is listed twice with FIPS 29186 and 29193.The calculated emissions table has values for both counties, but they are not identical. The density by county table has two different densities for the duplicate county. Assuming the density is correct for the correct county identifier 29186, the tool is run with the duplicate county 29193 removed from the county population and density by county tables.

Missouri's burn rate profile is listed as "3A". That profile contains all SCCs, the burn type (main, secondary, pleasure burning), and the cords of wood burned per year. The list of all burn rates for profile 3A are below.

SCC	SCC Description	Burn Type	Annual burn rate	Burn Unit
2104008100	Fireplace: general	Main	2	Cords
2104008210	Woodstove: fireplace inserts; non-EPA certified	Main	3	Cords
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	Main	2.37	Cords
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	Main	2.37	Cords
2104008310	Woodstove: freestanding, non-EPA certified	Main	3	Cords
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	Main	2.37	Cords
2104008330	Woodstove: freestanding, EPA certified, catalytic	Main	2.37	Cords
2104008400	Woodstove: pellet-fired, general	main	3	Ton
2104008510	Furnace: Indoor, cordwood-fired, non-EPA certified	Main	4	Cords
2104008610	Hydronic heater: outdoor	Main	5	Cords
2104009000	Residential Firelog Total: All Combustor Types	Main	0	Ton
2104008100	Fireplace: general	Secondary	0.8	Cords
2104008210	Woodstove: fireplace inserts; non-EPA certified	Secondary	1.5	Cords
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	Secondary	1.185	Cords
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	Secondary	1.185	Cords
2104008310	Woodstove: freestanding, non-EPA certified	Secondary	1.5	Cords
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	Secondary	1.185	Cords
2104008330	Woodstove: freestanding, EPA certified, catalytic	Secondary	1.185	Cords

SCC	SCC Description	Burn Type	Annual burn rate	Burn Unit
2104008400	Woodstove: pellet-fired, general	secondary	1	Ton
2104009000	Residential Firelog Total: All Combustor Types	Secondary	0.32	Ton
2104008100	Fireplace: general	Pleasure	0.3	Cords
2104008210	Woodstove: fireplace inserts; non-EPA certified	Pleasure	0.5	Cords
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	Pleasure	0.395	Cords
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	Pleasure	0.395	Cords
2104008310	Woodstove: freestanding, non-EPA certified	Pleasure	0.5	Cords
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	Pleasure	0.395	Cords
2104008330	Woodstove: freestanding, EPA certified, catalytic	Pleasure	0.395	Cords
2104008400	Woodstove: pellet-fired, general	pleasure	0.3	Ton
2104008610	Hydronic heater: outdoor	Pleasure	0	Cords
2104008700	Outdoor wood burning device, NEC	Pleasure	0.213	Cords
2104009000	Residential Firelog Total: All Combustor Types	Pleasure	0.14	Ton

For main heating sources, the estimate is that between 2 and 5 cords of wood per year could be used to heat a home. While this quantity of wood seems very low, and anecdotal evidence would show 5+ cords of wood per year for main heating for any appliance type, there is no vetted data source at this time to base a revised burn rate on. Future improvements to the estimate of emissions will include a Missouri-specific residential wood survey to update the burn rates, appliance population, and wood density.

The emission factor table was examined to look for outlier or unreasonable factors. The factor that stands out for closer examination is the SO_2 emission factor for indoor furnaces and outdoor wood boilers (hydronic heaters). The factor for these two appliance types is 2.03 lb/ton, while all other appliance types except pellet stoves have a factor of 0.4 lb/ton. Since SO_2 is a product of the fuel being burned, the factor should be the same across appliance types when using the same fuel type. The data source cited for the 2.03 lb/ton factor was unable to be located based on the non-specific reference of "MARAMA", so the factor is changed to match all other wood burning appliances. The list of SO_2 emission factors (in lbs/ton) are provided below.

SCC	Pollutant Code	SCC Level 4	Emission Factor	Data Source
2104008100	SO_2	Fireplace: general	0.4	2002 NEI
2104008210	SO_2	Woodstove: fireplace inserts; non-EPA certified	0.4	2002 NEI
2104008220	SO_2	Woodstove: fireplace inserts; EPA certified; non-catalytic	0.4	2002 NEI
2104008230	SO_2	Woodstove: fireplace inserts; EPA certified; catalytic	0.4	2002 NEI
2104008310	SO_2	Woodstove: freestanding, non-EPA certified	0.4	2002 NEI
2104008320	SO_2	Woodstove: freestanding, EPA certified, non-catalytic	0.4	2002 NEI

2104008330	SO_2	Woodstove: freestanding, EPA certified, catalytic	0.4	2002 NEI
2104008400	SO_2	Woodstove: pellet-fired, general	0.32	MARAMA
2104008510	SO_2	Furnace: Indoor, cordwood-fired, non-EPA certified	~~2.03~~	MARAMA
2104008610	SO_2	Hydronic heater: outdoor	~~2.03~~	From Woodstoves.

e. Emissions

Criteria pollutant emissions are listed by SCC below.

SCC	SCC Description	CO	NH_3	NO_X	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	VOC
2104008100	Fireplace: general	27,656.78	334.11	482.60	4,380.54	4,380.54	74.25	3,508.14
2104008210	Woodstove: fireplace inserts; non-EPA certified	20,347.31	149.87	246.85	2,697.69	2,697.69	35.26	4,672.48
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	3,958.89	25.31	64.11	551.10	551.10	11.25	337.41
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	978.55	8.44	18.75	191.21	191.21	3.75	140.60
2104008310	Woodstove: freestanding, non-EPA certified	18,632.92	137.24	226.05	2,470.40	2,470.40	32.29	4,278.79
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	3,627.03	23.18	58.73	504.90	504.90	10.30	309.12
2104008330	Woodstove: freestanding, EPA certified, catalytic	896.23	7.73	17.17	175.13	175.13	3.43	128.77
2104008400	Woodstove: pellet-fired, general	222.16	4.19	53.10	42.76	42.76	4.47	0.57
2104008510	Furnace: Indoor, cordwood-fired, non-EPA certified	2,445.49	23.98	24.53	367.62	367.62	27.04	157.17
2104008610	Hydronic heater: outdoor	6,061.87	30.31	31.01	1,077.67	1,077.67	34.18	1,134.92
2104008700	Outdoor wood burning device, NEC	88.31	1.07	1.54	13.99	13.99	0.24	11.20
2104009000	Total: All Combustor	595.64		36.59	139.62	135.24		188.39

	Types							
Statewide Total		85,511.19	745.42	1,261.01	12,612.61	12,608.23	236.47	14,867.55

The statewide GHG and HAP total for all residential wood SCCs is provided below for reference. The table is not broken into the separate SCCs due to length. Emissions are reported in tons per year.

Pollutant	Missouri Total (tons per year)
Carbon Dioxide	48,949.62
Methane	16,281.10
Formaldehyde	740.97
Benzene	622.34
Acetaldehyde	368.75
Phenol	178.90
Toluene	132.63
Cresols (Includes o, m, & p)/Cresylic Acids	132.10
1,3-Butadiene	108.92
Naphthalene	95.28
Acrolein	42.48
o-Xylene	37.46
Acenaphthylene	23.65
Phenanthrene	11.27
Fluorene	2.98
Pyrene	2.80
Fluoranthene	2.40
Benz[a]Anthracene	2.32
Anthracene	1.75
Chrysene	1.58
Benzo[e]Pyrene	1.34
Acenaphthene	1.33
Benzo[a]Pyrene	0.954
Benzo[g,h,i,]Perylene	0.876
Benzo[b]Fluoranthene	0.759
Benzo(g,h,i)Fluoranthene	0.664
Biphenyl	0.479
Indeno[1,2,3-c,d]Pyrene	0.475
Nitrous Oxide	0.317
Benzo[k]Fluoranthene	0.231

Pollutant	Missouri Total (tons per year)
Dibenzo[a,h]Anthracene	0.109
7,12-Dimethylbenz[a]Anthracene	0.087
Perylene	0.044
Manganese	0.036
Cadmium	0.005
Nickel	0.003
Mercury	0.002
Dioxins/Furans as 2,3,7,8-TCDD TEQs - WHO2005	1.09E-06
2,3,7,8-Tetrachlorodibenzofuran	5.34E-07
Octachlorodibenzo-p-Dioxin	2.84E-07
2,3,4,7,8-Pentachlorodibenzofuran	2.75E-07
1,2,3,7,8-Pentachlorodibenzofuran	1.95E-07
1,2,3,4,7,8-Hexachlorodibenzofuran	1.52E-07
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1.35E-07
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.28E-07
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	1.10E-07
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	1.07E-07
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1.07E-07
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	1.07E-07
1,2,3,4,7,8,9-Heptachlorodibenzofuran	9.99E-08
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	9.73E-08
1,2,3,6,7,8-Hexachlorodibenzofuran	9.39E-08
1,2,3,7,8,9-Hexachlorodibenzofuran	8.47E-08
Octachlorodibenzofuran	7.11E-08
2,3,4,6,7,8-Hexachlorodibenzofuran	7.04E-08

e. References

1. University of Missouri Extension “Wood Fuel for Heating” http://extension.missouri.edu/explorepdf/agguides/forestry/g05450.pdf

8.24 Solvent: Architectural Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.25 Solvent: Auto Refinishing/Auto Aftermarket

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.26 Solvent: Consumer and Commercial Household Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.27 Solvent: Consumer and Commercial Personal Care, Cosmetic, and Toiletries

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.28 Solvent: Consumer and Commercial Miscellaneous Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.29 Solvent: Consumer and Commercial Adhesives and Sealants

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.30 Solvent: Consumer and Commercial Auto Aftermarket

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.31 Solvent: Consumer and Commercial Coatings and Related Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.32 Solvent: Consumer and Commercial FIFRA Regulated Products

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.33 Solvent: Degreasing

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.34 Solvent: Dry Cleaning

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.35 Solvent: Graphic Arts

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.36 Solvent: Industrial Maintenance Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.37 Solvent: Other Special Purpose Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.38 Surface Coating: Aircraft

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.39 Surface Coating: Electronic and other Electric Coatings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.40 Surface Coating: Factory Finished Wood

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.41 Surface Coating: Large Appliances

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

Missouri DNR compared the NAICS 3352* (Household Appliances) against the list of ~500 point sources to be submitted to the EIS. No point source facilities were identified using the NAICS code.

County Business Patterns only identifies three facilities in three counties in Missouri with under 10 employees each. EPA's estimation method assigns 3 employees to each county and uses the VOC and HAP emission factors to estimate emissions.

County	Number of Employees Assigned
057- Dade	3
095- Jackson	3
099- Jefferson	3

Searching the wider universe of facilities who have ever submitted an EIQ to Missouri (regardless of PTE or point facility status) reveals no air permitted sources. Three facilities have been added to the facility list with NAICS of 3352*, but none of them have permits or are required to complete an emissions report. The largest employer, Tacony Manufacturing, assembles vacuums, but does not produce emissions. This larger search provides no indication that EPA's estimation method is incorrect.

8.42 Surface Coating: Machinery and Equipment

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.43 Surface Coating: Marine

The Missouri DNR accepted EPA's estimates of emissions for this source category but subtracted point source emissions from EPA's totals. No documentation was provided by EPA.

The NAICS 3366* and 488390* were compared against the list of ~500 point sources to be submitted to the EIS. Three point source facilities were identified using these NAICS codes. The following point sources with their number of employees are listed below:

County	Plant ID	Plant Name	NAICS	Product Description	Number of Employees
HENRY	0031	TRACKER MARINE	336612	FIBERGLASS BOATS	195
LACLEDE	0006	BRUNSWICK FRESHWATER GROUP	336612	BOATS, ALUMINUM	322
LACLEDE	0046	TRACKER MARINE	336612	ALUMINUM BOATS	497
LACLEDE	0038	G3 BOATS	336612	BOAT MFG	230
PEMISCOT	0030	TRINITY MARINE PRODUCTS INC	336611	BARGES	630

The following number of employees was subtracted from those counties:

County FIPS	County Name	EPA Estimate of all Point and Nonpoint Employees	Point Source Employees Subtracted	Employees Remaining in Nonpoint Estimate	Missouri Adjusted Final Number of Nonpoint Employees
083	HENRY	278	195	83	0
105	LACLEDE	1,081	1,049	32	0
155	PEMISCOT	556	630	0	0

Where there were remaining employees in the county, the County Business Patterns data was reviewed to see if the assumptions EPA used to "adjust" the number of withheld employees are reasonable, or if they inflate the number of employees higher than what the facility reports to the state.

For Henry County, 2010 CBP reports only one employer in the county with between 250 and 499 employees. The specific number of employees reported to Missouri for the single point source facility is 195 in 2011. It is reasonable to assume that EPA's method of assigning a specific value to the number of employees is inflating the employment tally in this county, and there should be no remaining nonpoint employees in Henry County, so the remaining nonpoint employees are removed.

For Laclede County, the 2010 CBP releases an actual number of employees of 1,081, with an undetermined number of facilities. Missouri point sources account for 1,049 of these employees based on their 2011 report. It is reasonable to assume that the difference in years could account for the fewer than 5% discrepancy in the number of employees. The remaining 32 nonpoint employees are zeroed out for this county and category.

After subtraction, the remaining counties where county business patterns identifies large numbers of employees that are not in the point source category are examined.

FIPS	County Name	EPA Estimated Number of Employees	Missouri Estimated Number of Employees
167	Polk	278	0
510	St. Louis City	149	149

In Polk County, there was a point source facility named “Tracker Marine – Bolivar Plant”. The facility reported over 200 employees before they shut down in July of 2009 per an air inspection. This facility should not have appeared in the 2010 County Business Patterns, where the report states that only one employer with between 250 and 499 employees existed. As there are no other employers in this NAICS in the county, EPA’s estimated number of employees (the adjusted county employee number), the county is zeroed out.

In St. Louis City, there are no other facilities Missouri is aware of in the NAICS of 3366* and 488390*. Missouri permits sources above certain de minimis thresholds as described in 10 CSR 10-6.060 and 10 CSR 10-6.065, therefore it is possible for facilities with smaller PTE to be unpermitted and unknown by the state. County business patterns state that there are three employer with NAICS 336611 (Ship building and repair) with between 100 and 249 employees total. CBP also cites that 3 employers in NAICS 488390 (Other support activities for water transportation) have total employment of 20 to 99 employees. The EPA method to adjust estimated ranges of employees to a specific number returns 149 employees in St. Louis City for marine surface coating. Since Missouri has no more specific information on permitted facilities engaged in marine operations in the county, Missouri will accept EPA’s estimate of 149 employees engaged in these activities in the county.

One county with a smaller remaining number of nonpoint employees is Camden County, 29029. EPA estimates 44 nonpoint employees in the county, and with the given emission factors, estimates 5 tons of VOC in this county. Missouri has a source in NAICS 3366*with a Basic operating permit in the county, Charger Inc. They provide periodic full EIQs, and have certified that for 2011, their emissions are within the range of 5 to 15 tons VOC. In the case of Camden County, EPA’s nonpoint estimate and Missouri-specific data are reasonably close.

This larger search provides no indication that EPA’s estimation method is incorrect, so point source subtraction is the only adjustment needed.

8.44 Surface Coating – Metal Can Coating

EPA provided an Access database with national metal can coating nonpoint emissions, and the Missouri DNR reviewed the file before making necessary adjustments.

EPA estimates emissions for VOC and three HAPs.

Pollutant Code	Pollutant Name	Emission Factor	Emission Factor Numerator	Emission Factor Denominator
VOC	Volatile Organic Compounds	3035	LB	EACH
67561	Methanol	406.69	LB	EACH
108883	Toluene	813.38	LB	EACH
107211	Ethylene Glycol	886.22	LB	EACH

EPA's estimation method relies on a count of the number of employees in each county in the industry. The US Census County Business Patterns gives this information by NAICS, but withholds certain employment numbers when a county only has one employer to avoid releasing confidential data. EPA has a methodology to take withheld county employment, given as a range of employees, to estimate a specific number of employees. Many other surface coating categories have an associated excel spreadsheet from EPA that demonstrates how the allocation of withheld employees is completed, but this work is not shown for this category. Missouri took the Access database and extracted Missouri's employment estimate by county.

State And County FIPS Code	County Name	SCC	Number of Employees
29021	Buchanan	2401040000	135.77
29031	Cape Girardeau	2401040000	7.75
29037	Cass	2401040000	7.75
29077	Greene	2401040000	46.55
29095	Jackson	2401040000	135.77
29099	Jefferson	2401040000	135.77
29107	Lafayette	2401040000	46.55
29109	Lawrence	2401040000	46.55
29155	Pemiscot	2401040000	7.75
29157	Perry	2401040000	46.55
29159	Pettis	2401040000	581.88
29189	St. Louis	2401040000	46.55

29205	Shelby	2401040000	7.75

The point sources being submitted to EPA were checked for NAICS 33243*.

County FIPS	County Name	Plant ID	Plant Name	NAICS	NAICS Description	Product Description	Number of Employees
29021	BUCHANAN	0064	SILGAN CONTAINERS CORP	332431	Metal Can Manufacturing	CANS MTL	205
29077	GREENE	0008	BRISTOL MANUFACTURING CORP	332439	Other Metal Container Manufacturing	STEEL DRUM CLEANING & REFURBISHMENT	120
29099	JEFFERSON	0044	METAL CONTAINER CORPORATION	332431	Metal Can Manufacturing	CANS BEER	174
29159	PETTIS	0012	WATERLOO INDUSTRIES INC	332439	Other Metal Container Manufacturing	METAL BOXES	650
29189	ST. LOUIS CO.	0226	GREIF-FENTON	332439	Other Metal Container Manufacturing	55 GALLON BARRELS	43

Removing the reported number of employees for point sources from Buchanan, Greene, Jefferson, Pettis and St. Louis Counties leaves the following numbers of employees:

State And County FIPS Code	County Name	SCC	Number of Employees
29021	Buchanan	2401040000	0
29031	Cape Girardeau	2401040000	7.75851393188855
29037	Cass	2401040000	7.75851393188855
29077	Greene	2401040000	0
29095	Jackson	2401040000	135.77399380805
29099	Jefferson	2401040000	0
29107	Lafayette	2401040000	46.5510835913313
29109	Lawrence	2401040000	46.5510835913313
29155	Pemiscot	2401040000	7.75851393188855
29157	Perry	2401040000	46.5510835913313
29159	Pettis	2401040000	0
29189	St. Louis	2401040000	0
29205	Shelby	2401040000	7.75851393188855

The county with the largest number of nonpoint employees is Jackson (29095) at 135 employees. Review of the US Census website (since EPA didn't provide how the final number was estimated) shows that there is one employer with between 100 and 249 employees in the county. Missouri has a previous

point source facility named Ball Metal Beverage Container Company in Jackson County (EIS Facility ID 7356411), with 147 employees, but the facility closed in September of 2009. The CBP should not continue to show this county with this number of employees, so the county nonpoint number of employees is being zeroed out.

Lawrence County shows 46 nonpoint employees, and CBP shows one employer with 20 to 99 employees. Missouri has a nonpoint facility named Silgan Container Company in Lawrence County, which reported 70 employees in 2011. They were a point source in 2008 (EIS Facility ID 7281811), but have since amended their permits and as of 2009, their potential emissions do not meet the AERR requirements to be a point source. As this facility is now included in the nonpoint category, its Missouri-submitted emissions are compared to EPA's nonpoint estimate for the county. EPA estimates at 3,035 pounds VOC per employee, the single Lawrence County facility emits over 70 tons of VOC per year. Silgan has reported to Missouri emissions of 4.23 tons VOC. Missouri will be replacing EPA's estimate with higher quality, bottom-up directly reported emission data from the facility. For VOC, emissions will be the facility total as reported. The facility was below the reporting threshold for HAP data, and as such, no HAP data will be submitted for this 4 ton VOC source.

Perry County shows 46 nonpoint employees, and CBP shows one employer with 20 to 99 employees. Missouri has a nonpoint facility named H and G Marine Service in Perry County (EIS Facility ID 7285511) which reports 12 employees as of 2010. It currently has the NAICS of 332313, Plate Work Manufacturing, and has permit limits that keep it under the AERR definition of point source, but until 2010 it's NAICS was 332439, Other Metal Container Manufacturing, and its emissions were large enough to be submitted as a point source under AERR's Type B threshold. As the facility is now included in the nonpoint category, its Missouri-submitted emissions are compared to EPA's nonpoint estimate for the county. EPA estimates, at 3,035 pounds VOC per employee, the single Perry County facility emits over 70 tons of VOC per year. H and G Marine have reported to Missouri for 2010 that their VOC emissions are 20.9 tons, and that their 2011 emissions are 5 tons plus or minus that value. To provide higher-quality, bottom-up inventory data for Perry County, Missouri will replace EPA's estimate with facility-reported emissions for both VOC and HAPs.

Cape Girardeau County has 7 nonpoint employees based on the EPA and CBP estimation method. CBP shows one facility with between 0 and 19 employees in the county, and that facility corresponds to the point source facility named Mid-South Products, Inc with 13 employees in 2011 (the NAICS is listed as 332322 according to Missouri). Since all emissions for this county will appear in the point source inventory, the nonpoint number of employees will be zeroed out.

Lafayette, Cass, Pemiscot, and Shelby counties were investigated to see if a very similar NAICS code point or nonpoint facility could be determined through Missouri records, but no such facilities were identified. These counties will have emission estimates identical to EPA's estimates.

The final emission estimates being reported to EPA for nonpoint surface coating of metal cans are:

County FIPS	County Name	Number of Employees	Pollutant Code	Total Emissions	Emissions Unit of Measure
29021	Buchanan	0	VOC	0	LB
29021	Buchanan	0	107211	0	LB
29021	Buchanan	0	67561	0	LB
29021	Buchanan	0	108883	0	LB
29031	Cape Girardeau	0	VOC	0	LB
29031	Cape Girardeau	0	107211	0	LB
29031	Cape Girardeau	0	67561	0	LB
29031	Cape Girardeau	0	108883	0	LB
29037	Cass	7.75	VOC	23547.08978	LB
29037	Cass	7.75	107211	6875.750217	LB
29037	Cass	7.75	67561	3155.310031	LB
29037	Cass	7.75	108883	6310.620062	LB
29077	Greene	0	VOC	0	LB
29077	Greene	0	107211	0	LB
29077	Greene	0	67561	0	LB
29077	Greene	0	108883	0	LB
29095	Jackson	0	VOC	0	LB
29095	Jackson	0	107211	0	LB
29095	Jackson	0	67561	0	LB
29095	Jackson	0	108883	0	LB
29099	Jefferson	0	VOC	0	LB
29099	Jefferson	0	107211	0	LB
29099	Jefferson	0	67561	0	LB
29099	Jefferson	0	108883	0	LB
29107	Lafayette	46.55	VOC	141282.5387	LB
29107	Lafayette	46.55	107211	41254.5013	LB
29107	Lafayette	46.55	67561	18931.86019	LB
29107	Lafayette	46.55	108883	37863.72037	LB
29109	Lawrence	0	VOC	4.23	TON
29155	Pemiscot	7.75	VOC	23547.08978	LB
29155	Pemiscot	7.75	107211	6875.750217	LB
29155	Pemiscot	7.75	67561	3155.310031	LB
29155	Pemiscot	7.75	108883	6310.620062	LB
29157	Perry	0	VOC	20.09	TON
29157	Perry	0	100414	569.11	LB
29157	Perry	0	1330207	4344.89	LB
29157	Perry	0	108101	15467.25	LB
29157	Perry	0	108883	9766.5	LB

County FIPS	County Name	Number of Employees	Pollutant Code	Total Emissions	Emissions Unit of Measure
29159	Pettis	0	VOC	0	LB
29159	Pettis	0	107211	0	LB
29159	Pettis	0	67561	0	LB
29159	Pettis	0	108883	0	LB
29189	St. Louis	0	VOC	0	LB
29189	St. Louis	0	107211	0	LB
29189	St. Louis	0	67561	0	LB
29189	St. Louis	0	108883	0	LB
29205	Shelby	7.75	VOC	23547.08978	LB
29205	Shelby	7.75	107211	6875.750217	LB
29205	Shelby	7.75	67561	3155.310031	LB
29205	Shelby	7.75	108883	6310.620062	LB

8.45 Surface Coating: Metal Furniture

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.46 Surface Coating: Miscellaneous Manufacturing

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

1. Category Description:

The category of miscellaneous manufacturing is covered by the SCC 2401090000.

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2401090000	Solvent Utilization	Surface Coating	Miscellaneous Manufacturing	Total: All Solvent Types

2. Estimation Method:

EPA's estimate is based on the US Census County Business Patterns database for 2010 that reports the number of employees by NAICS in each county. Some county employment data is withheld where release could be considered confidential data (especially where there is only one or two employers in the county). EPA uses an estimation method to take a range of employees and assign a specific number to each county with withheld data.

For Miscellaneous Manufacturing, EPA assigns employees in NAICS 339** and 3369* to this category. For Missouri, the adjusted employment in these NAICS is 9,108 employees.

3. Emission Factors

EPA proposes emission factors based on the number of employees in each county (pounds of pollutant released per employee per year). The only CAP with an emission factor is VOC, and nine HAPs are estimated. There is no documentation provided on the source of data for these emission factors.

CAS#	Chemical Name	Emission Factor
95476	o-Xylene	0.531418
100414	Ethyl Benzene	0.583173
108383	m-Xylene	1.20886
108101	Methyl Isobutyl Ketone	3.661701
106423	p-Xylene	0.538812
540885	Tert-butyl Acetate	2.308664
108883	Toluene	11.55441
110543	Hexane	21.84266
121448	Triethylamine	0.043438
VOC	VOC	92.42051

4. Controls

No controls are assumed for this category.

5. Emissions

EPA provides an estimate of statewide emissions for this SCC, and leaves it to the state to subtract out point source employees that overlap this NAICS. Missouri's point sources are listed below:

County FIPS	County Name	Plant ID	Plant Name	NAICS	NAICS Description	Product Description	Number of Employees
165	PLATTE	2415	HARLEY DAVIDSON MOTOR COMPANY	336991	Motorcycle, Bicycle, and Parts Manufacturing	MOTORCYCLES	900
510	ST. LOUIS CITY	1460	ALLIED HEALTH CARE PRODUCTS	339112	Surgical and Medical Instrument Manufacturing	MEDICAL GAS SYSTEMS/ MEDICAL PRODUCTS	520

The remaining categories with high assumed nonpoint employment are:

County FIPS	County name	Number of Employees Remaining
189	St. Louis	2611.46
095	Jackson	956.4601
183	St. Charles	588.7716
009	Barry	290.6557
187	St. Francois	290.6557
077	Greene	282
099	Jefferson	258
047	Clay	221
071	Franklin	170
021	Buchanan	164
097	Jasper	135.6393
181	Ripley	135.6393

St. Louis County has the highest number of nonpoint employees after considering point source subtraction. CBP states that over 2,600 employees work in NAICS 339** at over 120 employers. There are several facilities in Missouri's database of permitted emission sources with this NAICS in St. Louis County, but it is impossible to account for the sheer number of facilities and so any meaningful accounting association with nonpoint direct facility-reported emissions is not possible. The same can be said of all other counties that were examined – a large number of miscellaneous manufacturers make up the total, and individual facility contribution cannot be removed or itemized.

Total statewide emissions after point source subtraction for the miscellaneous manufacturing category are listed below.

Pollutant	Pollutant Code	Emissions (tons per year)
Volatile Organic Compounds	VOC	420.9
Hexane	110543	99.48
Toluene	108883	52.62
Methyl Isobutyl Ketone	108101	16.68
Tert-butyl Acetate	540885	10.51
m-Xylene	108383	5.51
Ethyl Benzene	100414	2.66
p-Xylene	106423	2.45
o-Xylene	95476	2.42
Triethylamine	121448	0.2

8.47 Surface Coating: Motor Vehicle

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.48 Surface Coating: Paper, foil, and film

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

Description:

Paper, foil and film surface coating emissions are covered by the following nonpoint SCC:

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2401030000	Solvent Utilization	Surface Coating	Paper: SIC 26	Total: All Solvent Types

Activity:

EPA estimates activity by the number of reported employees in the US Census County Business Patterns database for NAICS 322221*, 322222*, 322223*, 322225* and 322226*. The employment table for Missouri counties is below:

FIPS State and County Code	fipstate	fipscty	naics	empflag	emp	Ranges	Midpoint
29047	29	047	322221	B	0	20-99	60
29047	29	047	322222	B	0	20-99	60
29077	29	077	322222	A	0	0-19	10
29077	29	077	322223	A	0	0-19	10
29139	29	139	322226	A	0	0-19	10
29165	29	165	322222	B	0	20-99	60
29183	29	183	322222	C	0	100-249	175
29189	29	189	322221		17	0	0
29189	29	189	322222		38	0	0
29510	29	510	322223	C	0	100-249	175
29510	29	510	322226	A	0	0-19	10

Emission Factors:

EPA's spreadsheet that calculates activity and emissions for VOC contains a list of HAP emission factors that is different in values and number of HAPs compared to the Access database with national emissions of CAP and HAP already completed.

	Spreadsheet	Database
Pollutant Code	EF	EF
107211	3.3075	
171	10.1577	
78933	26.46	
1330207	16.17	
71556	5.88	
108883	19.11	76.13718
108101	61.005	24.12858
100414		3.84279
106423		3.55047
108383		7.96572
110543		143.93106
121448		0.28623
540885		15.21282
95476		3.50175
VOC	609.3887738	609

Missouri will use the HAP emission factors from the database when doing point source adjustments as these are the emissions EPA intends to use for gap filling where states submit no data.

Point Source Subtraction

Point source employment in NAICS 322221*, 322222*, 322223*, 322225* and 322226* returns a single source:

Count FIPS	County Name	Plant ID	Plant Name	NAICS	Number of Employees
29510	ST. LOUIS CITY	0118	JW ALUMINUM	322225	250

County Business Patterns identifies two employers in the 249-499 number of employee range. One of the employers is in the range of 100-249 (JW Aluminum fits this category and is a point source), and another facility is within the range of 0-19 employees. A nonpoint facility with air permits is National Graphics (aka IJ Technologies) with NAICS 322222. They've reported 10 employees as of 2006, and CBP agrees they're still in this range. Their reported VOC emissions as a nonpoint source directly reporting to the state are 0.24 tons VOC in 2011. Subtracting the number of point source employees from EPA's estimated total for the county leaves (333-250) 83 employees as nonpoint. This estimate is not reasonable given the single nonpoint source direct report, so Missouri will substitute the bottom-up data from National Graphics as higher quality data compared to EPA's estimate. This county will not have HAP data as they are below the HAP reporting threshold.

Nonpoint comparisons:

The remaining counties with EPA-estimated nonpoint employees and emissions are compared to the emissions database for Missouri containing other permitted sources that do not meet EPA's AERR definition of Type A or B point source.

County FIPS	County Name	Number of Remaining Nonpoint Employees
29183	St. Charles	118
29047	Clay	78
29189	St. Louis	55
29165	Platte	41
29139	Montgomery	29
29077	Greene	24

In St. Charles County, two facilities show up on the list: EHV Weidmann Industries has a rotogravure printer for sheet printing of electrically conductive papers, and RX Systems prints paper materials for the pharmaceutical industry. Both facilities do not meet the AERR definition of point source, and have reported emissions to Missouri of less than 5 tons VOC. Neither of these facilities have reported their number of employees to Missouri, and CBP shows seven facilities comprise the total nonpoint employment in this county. Without complete employer and facility data, there is no justification to change EPA's emission estimate for this county.

In Clay County, CBP lists one employer with between 20 and 99 employees in NAICS 32221. Missouri's data shows one nonpoint facility, Pioneer Container Corporation with 74 employees. Their last reported emissions for 1996 were 3.91 tons of VOC. EPA's estimate puts them at 23 tons of VOC, which seems unreasonable given their current permit type. Missouri will use the bottom-up facility reported VOC emissions in place of EPA's estimate for this nonpoint county estimate. This county does not have HAP emissions as they are below the HAP reporting threshold.

In St. Louis County, there are no sources with this NAICS according to Missouri's data. EPA's estimate is accepted.

In Platte County, there are no sources with this NAICS according to Missouri's data. EPA's estimate is accepted.

In Montgomery County, there are no sources with this NAICS according to Missouri's data. EPA's estimate is accepted.

In Greene County, there are multiple employers according to CBP, and only one out of business facility in Missouri's data. There is not enough Missouri-specific information to verify EPA's estimate, and it is accepted as-is.

Emissions

Emissions of VOC and HAPs are summarized by county below in pounds per year. All counties not listed have zero emissions for this SCC.

County FIPS	County Name	Ethyl Benzene	p-Xylene	Methyl Isobutyl Ketone	m-Xylene	Toluene	Hexane	Triethylamine	Tert-butyl Acetate	o-Xylene	VOC
29047	Clay										7,820.00
29077	Greene	92.23	85.21	579.09	191.18	1,827.29	3,454.35	6.87	365.11	84.04	14,707.00
29139	Montgomery	111.44	102.96	699.73	231.01	2,207.98	4,174.00	8.30	441.17	101.55	17,529.00
29165	Platte	157.55	145.57	989.27	326.59	3,121.62	5,901.17	11.74	623.73	143.57	24,695.00
29183	St. Charles	453.45	418.96	2,847.17	939.95	8,984.19	16,983.87	33.78	1,795.11	413.21	72,028.00
29189	St. Louis	211.35	195.28	1,327.07	438.11	4,187.54	7,916.21	15.74	836.71	192.60	33,516.00
29510	St. Louis City										480.00

8.49 Surface Coating: Railroad

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

1. Category Description

Surface coating of railroad equipment and rolling stock is covered by the following nonpoint SCC

SCC	**SCC Level One**	**SCC Level Two**	**SCC Level Three**	**SCC Level Four**
2401085000	Solvent Utilization	Surface Coating	Railroad: SIC 374	Total: All Solvent Types

2. Emission Factors

EPA's spreadsheet and the Access database contain differing numbers of HAP pollutants and different emission factors.

	Access DB	Spreadsheet
Pollutant Code	Emission Factor	Emission Factor
100414	3.12832	None
108883	41.44816	5.772
110543	73.8608	None
1330207	12.03488	4.884
VOC	208	208
74556	none	1.776
78933	none	7.992
171	none	3.068
107211	none	0.999

The Access database emission factors are used for Missouri's estimate as EPA intends to submit this data to the EIS as a national default.

3. Point Source Subtraction

For point sources with NAICS 3365*, the following point source in Jefferson County has more reported employees than the EPA CDB estimation method for the single employer in the county. For Jefferson County, there are no nonpoint emissions for railroad surface coating.

County	County Name	Plant Number	Plant Name	Site Name	NAICS	NAICS Description	Product Description	Number of Employees
095	JACKSON	2035	WABTEC KANSAS CITY SERVICE CENTER	WABTEC KANSAS CITY SERVICE CENTER	336510	RAILROAD ROLLING STOCK MANUFACTURING	RAILCAR PARTS RMFGF	228
099	JEFFERSON	0011	UNION PACIFIC RAILROAD CO	DESOTO CAR SHOP	336510	RAILROAD ROLLING STOCK MANUFACTURING	RAILCARS	316

For Jackson County, a nonpoint permitted facility named Wabtec Kansas City Service Center has reported 228 employees to Missouri, with 3.4 tons of VOC emissions. The CBP database shows only one employer in the county with a range from 100-249 employees. Since there are no unaccounted for employees in the county, and the nonpoint estimation method is significantly higher than this (12 tons VOC), the more accurate, bottom-up reported emissions are used in place of EPA's estimate.

The final emissions submitted for this category (all other Missouri counties are submitted with zero emissions):

State And County FIPS Code	County Name	Emissions Unit of Measure Code	Ethyl Benzene	Hexane	Toluene	Volatile Organic Compounds	Xylenes (Mixed Isomers)
29031	Cape Girardeau	LB	188	4432	2487	12498	722
29043	Christian	LB	188	4432	2487	12498	722
29069	Dunklin	LB	188	4432	2487	12498	722
29095	Jackson	LB	0	0	0	6800	0
29099	Jefferson	LB	0	0	0	0	0

8.50 Surface Coating: Traffic Markings

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.51 Surface Coating: Wood Furniture

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

8.52 Landfills

a. Source Category Description

Emissions from landfills include criteria and HAP pollutants, along with GHG pollutants not covered by this inventory. Landfills with large capacity and methane generation potential are subject to Part 70 operating permit requirements, and are therefore included in the point source part of the inventory. The list of point source landfills is in the table below.

County Name	County Code	Plant Identifier	Plant Name	Site Name	Operating Permit Type	SIC	NAICS
BOONE	019	0091	COLUMBIA SANITARY LANDFILL	COLUMBIA	P70	4953	562212
BUCHANAN	021	0105	ST. JOSEPH LANDFILL	50TH ROAD SE	P70	4953	562212
BUTLER	023	0058	BUTLER COUNTY LANDFILL	BUTLER COUNTY SANITARY LANDFILL	P70	4953	562212
COLE	051	0058	JEFFERSON CITY LANDFILL LLC	JEFFERSON CITY	P70	4953	562212
GREENE	077	0161	SPRINGFIELD SANITARY LANDFILL	WILLARD	P70	4953	562212
JACKSON	095	0267	COURTNEY RIDGE LANDFILL, LLC	COURTNEY RIDGE LANDFILL	P70	4953	562212
JACKSON	095	0273	RUMBLE RECYCLING AND DISPOSAL SERVICES	SANITARY LANDFILL RUMBLE 1 & 2	P70	4953	562212
JACKSON	095	2101	SOUTHEAST LANDFILL, LLC	KANSAS CITY LANDFILL	P70	4953	562212
JACKSON	095	0272	LEE'S SUMMIT SANITARY LANDFILL	LEE'S SUMMIT SANITARY LANDFILL	P70	4953	562212
BARTON	011	0039	PRAIRIE VIEW REGIONAL WASTE FACILITY	LAMAR	P70	4953	562212
LEWIS	111	0025	BFI BACKRIDGE LANDFILL	LAGRANGE	P70	4953	562212
WRIGHT	229	0022	BLACK OAK RECYCLING & DISPOSAL FACILITY	DIV WASTE CORPORATION OF MISSOURI INC	P70	4953	562212
MACON	121	0027	VEOLIA ES MAPLE HILL LANDFILL, INC	MACON	P70	4953	562212
PETTIS	159	0055	CENTRAL MISSOURI SANITARY LANDFILL	CENTRAL MISSOURI SANITARY LANDFILL	P70	4953	562212
PIKE	163	0040	EAGLE RIDGE LANDFILL	BOWLING GREEN	P70	4953	562212
ST. LOUIS CO.	189	0281	BFI MISSOURI PASS	MARYLAND	P70	4953	562212

County Name	County Code	Plant Identifier	Plant Name	Site Name	Operating Permit Type	SIC	NAICS
			LANDFILL	HEIGHTS			
ST. LOUIS CO.	189	0308	IESI MO CHAMP LANDFILL	ST. LOUIS COUNTY	P70	4953	562212
ST. LOUIS CO.	189	0310	ADVANCED DISPOSAL SERVICES	OAK RIDGE LANDFILL	P70	4953	562212
ST. LOUIS CO.	189	0312	BRIDGETON LANDFILL, LLC	BRIDGETON	P70	4953	562212
STODDARD	207	0062	LEMONS SANITARY LANDFILL	DEXTER	P70	4953	562212
WASHINGTON	221	0031	IESI CORPORATION	TIMBER RIDGE LANDFILL	P70	4953	562212
JOHNSON	101	0046	SHOW-ME REGIONAL LANDFILL	SHOW-ME REGIONAL LANDFILL	P70	4953	562212

For this source category, the following SCC was assigned:

Source Classification Code	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2320000000	Waste Disposal, Treatment, and Recovery	Landfills	All Categories	Total

b. Activity Data

The small landfills in Missouri are not permitted, and therefore aren't subject to reporting requirements that would allow bottom-up inventory development with state-specific data. EPA has not provided a nonpoint estimate starting point for states for 2011. EPA's 2008 NEI v2 documentation states on page 7:

"Landfills have not been estimated by EPA for the 2008 NEI, as had been done in earlier NEI years. Some States do report some pollutants for some of their larger landfills, and these have been included in the 2008 NEI. This is expected to be largely an issue for some toxics. The scope of the underestimate is uncertain, due to an expectation that many landfills have been adding gas collection systems as a result of various control programs and the value of the collected gas as a fuel. "

As such, Missouri is choosing not to provide a nonpoint emission estimate for landfills and will let the point source landfills stand on their own.

f. References

1. 2008 NEI Version 2 Technical Support Documentation (draft), updated 6/2012. Accessed 10-25-2012 at http://www.epa.gov/ttn/chief/net/2008neiv2/2008_neiv2_tsd_draft.pdf

8.53 Publically Owned Treatment Works

The Missouri DNR accepted EPA's estimates of emissions for this source category. EPA is pulling this emission estimate forward as-is from 2008 to 2011 with no updates. Missouri sees no problems with this method, and has no point source subtraction to complete for this category. The documentation below was developed by EPA.

Source Category Description

Publicly Owned Treatment Works (POTW) means a treatment works that is owned by a state, municipality, city, town, special sewer district, or other publicly owned and financed entity as opposed to a privately (industrial) owned treatment facility. The definition includes intercepting sewers, outfall sewers, sewage collection systems, pumping, power, and other equipment. The wastewater treated by these POTWs is generated by industrial, commercial, and domestic sources.[1]

The general approach to calculating emissions for POTWs is to estimate the 2008 national POTW flow rate using methods described below and then multiply the estimated flow rate by the emission factors for VOCs, ammonia, and 53 HAPs. The emissions are allocated to the county level using methods described below.

Activity Data

A nationwide projected flow rate in 2010 of 39,780 million gallons per day (MMGD) was available from an EPA report.[2] Of this, POTWs account for 98.5 percent of the flow rate or 39,180 MMGD, with privately owned treatment works accounting for the rest. The EPA Clean Watersheds Needs Survey reports the existing flow rate in 2004 for POTWs as 34,370 MMGD.[3] The interpolated 2008 nationwide flow rate (using a linear regression) was calculated at 37,580 MMGD, or 13,754,280 million gallons annually. The nationwide flow rate includes Puerto Rico and the U.S. Virgin Islands.

Emission Factors

The ammonia emission factor was obtained from a report to EPA[4], while the VOC emission factor was based on a TriTAC study.[5] Emission factors for the 53 HAPs were derived using 1996 area source emissions estimates that were provided by ESD[6] and the 1996 nationwide flow rate.[7] These HAP emission factors were then multiplied by the 2008 to 2002 VOC emission factor ratio (0.85/9.9) to obtain the final HAP emission factors applied in the 2008 inventory. The emission factors, pollutant codes, and pollutant descriptions are reported in the table below.

Criteria and HAP Emission Factors for Publicly Owned Treatment Works (SCC 2630020000): Not Adjusted for Point Source Emissions

Pollutant Description	NIF 3.0 Pollutant Codes	Emission Factor (lb/MMGAL)	Emission Factor Reference(s)
1,1,2,2-TETRACHLOROETHANE	79345	1.75E-06	6, 7
1,1,2-TRICHLOROETHANE	79005	1.17E-06	6, 7
1,2,4-TRICHLOROBENZENE	120821	8.67E-05	6, 7
1,3-BUTADIENE	106990	2.51E-05	6, 7
1,4-DICHLOROBENZENE	106467	2.16E-04	6, 7
1-CHLORO-2,3-EPOXYPROPANE	106898	4.52E-06	6, 7
2,4-DINITROTOLUENE	121142	4.81E-05	6, 7
2-NITROPROPANE	79469	2.92E-07	6, 7
ACETALDEHYDE	75070	3.10E-04	6, 7
ACETONITRILE	75058	3.45E-04	6, 7
ACROLEIN	107028	3.84E-04	6, 7
ACRYLONITRILE	107131	3.86E-04	6, 7
ALLYL CHLORIDE	107051	1.94E-05	6, 7
AMMONIA	NH_3	1.69E-01	4
BENZENE	71432	6.73E-03	6, 7
BENZYL CHLORIDE	100447	8.17E-06	6, 7
BIPHENYL	92524	7.52E-05	6, 7
CARBON DISULFIDE	75150	4.32E-03	6, 7
CARBON TETRACHLORIDE	56235	1.12E-03	6, 7
CHLOROBENZENE	108907	4.83E-04	6, 7
CHLOROFORM	67663	6.44E-03	6, 7
CHLOROPRENE	126998	2.38E-05	6, 7
CRESOLS (INCLUDES O, M, & P)/CRESYLIC ACIDS	331	1.61E-06	6, 7
DIMETHYL SULFATE	77781	1.31E-06	6, 7
ETHYL ACRYLATE	140885	1.75E-06	6, 7
ETHYL BENZENE	100414	7.66E-03	6, 7
ETHYLENE OXIDE	75218	2.22E-04	6, 7
FORMALDEHYDE	50000	1.97E-05	6, 7
GLYCOL ETHERS	171	1.15E-02	6, 7
HEXACHLOROBUTADIENE	87683	7.29E-07	6, 7
HEXACHLOROCYCLOPENTADIENE	77474	5.83E-07	6, 7
METHANOL	67561	1.14E-02	6, 7
METHYL CHLOROFORM	71556	5.63E-04	6, 7
METHYL ETHYL KETONE	78933	2.84E-03	6, 7
METHYL ISOBUTYL KETONE	108101	2.69E-03	6, 7
METHYL METHACRYLATE	80626	3.11E-04	6, 7
METHYL TERT-BUTYL ETHER	1634044	6.37E-05	6, 7
METHYLENE CHLORIDE	75092	9.10E-03	6, 7
N,N-DIMETHYLANILINE	121697	3.22E-04	6, 7
NAPHTHALENE	91203	1.31E-03	6, 7

Pollutant Description	NIF 3.0 Pollutant Codes	Emission Factor (lb/MMGAL)	Emission Factor Reference(s)
NITROBENZENE	98953	6.56E-06	6, 7
O-TOLUIDINE	95534	1.75E-06	6, 7
P-DIOXANE	123911	1.79E-05	6, 7
PROPIONALDEHYDE	123386	3.50E-06	6, 7
PROPYLENE DICHLORIDE	78875	1.15E-05	6, 7
PROPYLENE OXIDE	75569	7.32E-04	6, 7
STYRENE	100425	2.73E-03	6, 7
TETRACHLOROETHYLENE	127184	4.27E-03	6, 7
TOLUENE	108883	1.23E-02	6, 7
TRICHLOROETHYLENE	79016	3.06E-04	6, 7
VINYL ACETATE	108054	7.66E-05	6, 7
VINYL CHLORIDE	75014	6.71E-06	6, 7
VINYLIDENE CHLORIDE	75354	4.23E-04	6, 7
VOLATILE ORGANIC COMPOUNDS	VOC	8.50E-01	5
XYLENES (MIXTURE OF O, M, AND P ISOMERS)	1330207	5.98E-02	6, 7

lb/MMGAL = pounds per million gallons

Emissions

Emissions were allocated to the county-level by the county proportion of the U.S. population.[8]

It is important to note that the emission estimates for this category represent total emissions. It may be necessary to determine whether there are point source emissions in SCCs 50100701 through 50100781 and 50100791 through 50182599 that need to be subtracted to yield the nonpoint source emission estimates for this category.

Sample Calculations:

The 1996 flow rate per day was 32,175 MMGD. (1996 was a leap year.) Annually, this computes to:

32,175 MMGD treated * 366 days = 11,776,050 million gallons treated

Benzene emissions in 1996 for area source POTWs were estimated to be 461.44 tons per year. The derived benzene emission factor is calculated as follows:

Benzene emission factor = ((461.44 tons * 2000 lb/ton) / (11,776,050 million gallons treated)) * (0.85/9.9)

Benzene emission factor = 0.0067287 lb/million gallons treated

Benzene emissions for 2008 for area source POTWs are calculated as follows:

2008 Benzene emissions = (37,580 MMGD * 366 days) * (0.0067287 lb/million gallons treated)

2008 Benzene emissions = 92,548 pounds / 2,000 pounds = 46.27 tons/year

Total national 2008 benzene emissions from area source POTWs are allocated to county-level by the county proportion of the U.S. population. The total U.S. population in 2008 is 308,123,578. Benzene emissions for Autauga County, Alabama (2008 population of 50,364) are calculated as follows:

2008 emissions = 46.27 tons/year * 50,364/308,123,578 = 0.0076 tons/year

References

1. U.S. Environmental Protection Agency, 64FR57572, National Emission Standards for Publicly Owned Treatment Works, Final Rule, 40 CFR Part 63, 26 October 1999.
2. U.S. Environmental Protection Agency, "Wastewater Flow Projections for POTWs and Privately and Federally Owned Treatment Works in 2000, 2005, and 2010," Table A-8 in *Biosolids Generation, Use, and Disposal in the United States*, EPA530-R-99-009, September 1999.
3. U.S. Environmental Protection Agency, Clean Watersheds Needs Survey, Ask WATERS Online Database Query Tool, at http://iaspub.epa.gov/waters10/query_tool.criteria?srept_no=165&branding=15, accessed 19 May 2009.
4. Stephen M. Roe, Melissa D. Spivey, Holly C. Lindquist, Kirstin B. Thesing, and Randy P. Strait, E.H. Pechan & Associates, Inc., *Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources – Draft Final Report*, prepared for U.S. Environmental Protection Agency, Emission Inventory Improvement Program, April 2004.
5. Prakasam Tata, Jay Witherspoon, Cecil Lue-Hing (eds.), VOC Emissions from Wastewater Treatment Plants: Characterization, Control, and Compliance, Lewis Publishers, 2003, p. 261.
6. Memorandum from Bob Lucas, U.S Environmental Protection Agency to Greg Nizich, U.S. Environmental Protection Agency, "Review of Baseline Emissions Inventory," 16 October 1998.
7. U.S. Environmental Protection Agency, "Facilities Database (Needs Survey) - Frequently Asked Questions," at http://www.epa.gov/owm/mtb/cwns/1996rtc/faqwfd.htm, accessed 22 May 2009.

8. U.S. Census Bureau, "Population Estimates," at http://www.census.gov/popest/estimates.html, released 14 May 2009 with population estimates as of 1 July 2008. Note: The U.S. Census Bureau estimate does not include the U.S. Virgin Islands, so the Census Bureau estimate was supplemented with Virgin Island population data from U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *Demographic Baseline Report of U.S. Territories and Counties Adjacent to Coral Reef Habitats*, June 2008, at http://coris.noaa.gov/activities/coral_demographics, accessed 9 June 2009.

8.54 Cremation: Human and Animal

The Missouri DNR developed the following estimate of emissions and documentation for this source category.

a. Source Category Description

Human and animal cremation is the process of disposing of carcasses in a high temperature incineration chamber. Criteria air pollutant (CAP) and hazardous air pollutant (HAP) emission estimates for cremation are reported as the mass of material incinerated combined with an emission factor for each pollutant.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2810060100	Miscellaneous Area Sources	Other Combustion	Cremation	Humans
2810060200	Miscellaneous Area Sources	Other Combustion	Cremation	Animals

b. Activity Data

Missouri chose between two methods to develop emissions for this category: use emission inventory data collected from specific, stationary crematory sites, or use surrogate activity data with emission assumptions.

The Emission Inventory Improvement Program[4] (EIIP) Volume 3, Chapter 1 describes area source (now known as nonpoint source) emission estimation methods states can choose from. To obtain the most accurate inventory, the most specific data collected and quality assured is preferable to surrogate activity data that is allocated to the geographic region of interest. For the human or animal crematory category, these facilities have reported emissions directly to the state of Missouri as described in section c. Using quality assured facility-reported data ensures that the inventory is developed in a bottom-up fashion, as opposed to a top-down method where activity data from a much larger geographic region is used to estimate emissions and allocated down to the county level.

The bottom-up approach for Missouri relies on facility submitted emission reports required by 10 CSR 10-6.110. Crematory facilities are not required to submit detailed emission reports annually due to their permit type and

potential to emit – they can roll forward a representative year's emissions as long as the total emissions change less than 5 tons and they have no new permitted equipment operating in the year. For the majority of these facilities, emissions vary less than 2 tons per year due to their steady nature of operation and consistent emission rates. It is reasonable to assume a past emission report is representative of the 2011 year for this category.

c. Controls

Emissions from crematory operations may include a very small amount of several chemicals. Controls are seldom used for this process. Afterburners are the most frequently used for the sites which have controlled emissions. Of the 90 crematory sites in Missouri, 14 use control equipment.

d. Emission Factors

The statewide average for the emission factor of the criteria pollutants are listed in the following table:

Pollutant	Emission Factor (lbs/ton cremated)
PM_{10}	3.152
SO_x	2.296
NO_x	4.296
VOC	3.482
CO	2.783
$PM_{2.5}$	1.973

An examination of the range of values for the emission factors was done to determine the effect of changing the high and low end values of the emission factor. The webFIRE factor was used for the sites which used factors significantly different than the webFIRE factor. The emissions would change minimally (about 0.02 tons or 40 pounds per pollutant), so the emission factors have a negligible effect on the total emissions.

Criteria pollutants are included in Missouri's data as not all facilities reported HAP data due to the reporting threshold of 20 or 200 lbs per year, depending on the HAP pollutant. EPA has provided estimates of HAPs for this category, and they may choose to use them where Missouri does not provide data.

e. Crematory Sites

When the list was initially pulled from the Missouri Emission Inventory database the sites were queried by SIC/NAICS. Incinerators which were in grocery stores that burned cardboard boxes were on the initial list. Currently, all those incinerators are shut down but the grocery stores are still active and exist in the database. To eliminate facilities which do not cremate the second criteria was added to the query – SCCs which are specific to cremation. Hospitals which cremate remains would not be included on the list because of the SIC/NAICS they have even though they use the SCCs which are specific to cremation. The list which was generated is 90 active facilities.

The sites in Missouri were selected based on a combination of the NAICS/SIC and the SCC used on the emission inventory questionnaires. The following tables show which codes were selected and their descriptions.

Crematory NAICS			
NAICS	**NAICS description**	**SIC**	**SIC description**
562213	Solid Waste Combustors and Incinerators	4953	Refuse Systems (solid waste combustors and incinerators)
812210	FUNERAL HOMES AND FUNERAL SERVICES	7261	FUNERAL SERVICES AND CREMATORIES (FUNERAL HOMES AND SERVICES)
812220	CEMETERIES AND CREMATORIES	7261	FUNERAL SERVICES AND CREMATORIES (CREMATORIES)
812910	PET CARE (EXCEPT VETERINARY) SERVICES	0752	ANIMAL SPECIALTY SERVICES, EXCEPT VETERINARY (PET CARE SERVICES, EXCEPT VETERINARY)

Crematory SCC				
SCC code	**Level 1 Description**	**Level 2 Description**	**Level 3 Description**	**Level 4 Description**
31502101	Industrial Processes	Photographic Equipment/Health Care/Laboratories	Health Care - Crematoriums	Crematory Stack

Crematory SCC				
SCC code	**Level 1 Description**	**Level 2 Description**	**Level 3 Description**	**Level 4 Description**
31502102	Industrial Processes	Photographic Equipment/Health Care/Laboratories	Health Care - Crematoriums	Crematory Stack - Human and Animal Crematories
50100505	Waste Disposal	Solid Waste Disposal - Government	Other Incineration	Medical Waste Incinerator, unspecified type, Infectious wastes only
50200101	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration	Multiple Chamber
50200501	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration: Special Purpose	Med Waste Controlled Air Incin-aka Starved air, 2-stg, or Modular comb
50200504	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration: Special Purpose	Medical Waste Incinerator, unspecified type (use 502005-01, -02, -03)
50200505	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Incineration: Special Purpose	Medical Waste Incinerator, unspecified type, Infectious wastes only

The table below shows which counties have these sites as well the count of each. One site on the list (in Pettis County) had a facility which processed both human and animal remains at their location.

County	County Name	Number of sites	Animal Crematories	Human Crematories
29001	ADAIR	1	0	1
29003	ANDREW	0	0	0
29005	ATCHISON	0	0	0
29007	AUDRAIN	0	0	0
29009	BARRY	1	0	1
29011	BARTON	0	0	0
29013	BATES	0	0	0
29015	BENTON	2	0	2
29017	BOLLINGER	0	0	0
29019	BOONE	6	2	4
29021	BUCHANAN	2	0	2
29023	BUTLER	1	0	1
29025	CALDWELL	0	0	0
29027	CALLAWAY	1	0	1
29029	CAMDEN	1	0	1
29031	CAPE GIRARDEAU	3	2	1
29033	CARROLL	0	0	0
29035	CARTER	0	0	0
29037	CASS	0	0	0
29039	CEDAR	0	0	0
29041	CHARITON	0	0	0

County	County Name	Number of sites	Animal Crematories	Human Crematories
29043	CHRISTIAN	0	0	0
29045	CLARK	0	0	0
29047	CLAY	2	2	0
29049	CLINTON	1	1	0
29051	COLE	2	2	0
29053	COOPER	1	1	0
29055	CRAWFORD	0	0	0
29057	DADE	0	0	0
29059	DALLAS	0	0	0
29061	DAVIESS	0	0	0
29063	DE KALB	0	0	0
29065	DENT	0	0	0
29067	DOUGLAS	0	0	0
29069	DUNKLIN	0	0	0
29071	FRANKLIN	1	0	1
29073	GASCONADE	0	0	0
29075	GENTRY	0	0	0
29077	GREENE	3	0	3
29079	GRUNDY	0	0	0
29081	HARRISON	0	0	0
29083	HENRY	0	0	0
29085	HICKORY	0	0	0
29087	HOLT	0	0	0
29089	HOWARD	0	0	0
29091	HOWELL	1	0	1
29093	IRON	0	0	0
29095	JACKSON	10	4	6
29097	JASPER	7	3	4
29099	JEFFERSON	2	1	1
29101	JOHNSON	2	1	1
29103	KNOX	0	0	0
29105	LACLEDE	1	1	0
29107	LAFAYETTE	0	0	0
29109	LAWRENCE	0	0	0
29111	LEWIS	0	0	0
29113	LINCOLN	0	0	0
29115	LINN	0	0	0
29117	LIVINGSTON	1	1	0
29119	MCDONALD	0	0	0

County	County Name	Number of sites	Animal Crematories	Human Crematories
29121	MACON	0	0	0
29123	MADISON	0	0	0
29125	MARIES	1	1	0
29127	MARION	0	0	0
29129	MERCER	0	0	0
29131	MILLER	0	0	0
29133	MISSISSIPPI	0	0	0
29135	MONITEAU	0	0	0
29137	MONROE	0	0	0
29139	MONTGOMERY	0	0	0
29141	MORGAN	0	0	0
29143	NEW MADRID	0	0	0
29145	NEWTON	0	0	0
29147	NODAWAY	0	0	0
29149	OREGON	1	1	0
29151	OSAGE	0	0	0
29153	OZARK	0	0	0
29155	PEMISCOT	1	1	0
29157	PERRY	0	0	0
29159	PETTIS	1	1	1
29161	PHELPS	4	3	1
29163	PIKE	0	0	0
29165	PLATTE	2	1	1
29167	POLK	1	1	0
29169	PULASKI	2	1	1
29171	PUTNAM	0	0	0
29173	RALLS	0	0	0
29175	RANDOLPH	0	0	0
29177	RAY	0	0	0
29179	REYNOLDS	0	0	0
29181	RIPLEY	0	0	0
29183	ST. CHARLES	6	2	4
29185	ST. CLAIR	0	0	0
29186	STE. GENEVIEVE	0	0	0
29187	ST. FRANCOIS	3	0	3
29189	ST. LOUIS CO.	10	1	9
29195	SALINE	0	0	0
29197	SCHUYLER	0	0	0
29199	SCOTLAND	0	0	0

County	County Name	Number of sites	Animal Crematories	Human Crematories
29201	SCOTT	0	0	0
29203	SHANNON	0	0	0
29205	SHELBY	0	0	0
29207	STODDARD	1	0	1
29209	STONE	1	0	1
29211	SULLIVAN	0	0	0
29213	TANEY	0	0	0
29215	TEXAS	0	0	0
29217	VERNON	0	0	0
29219	WARREN	0	0	0
29221	WASHINGTON	0	0	0
29223	WAYNE	0	0	0
29225	WEBSTER	1	1	0
29227	WORTH	0	0	0
29229	WRIGHT	0	0	0
29510	ST. LOUIS CITY	3	2	1
Total Statewide		**90**	**37**	**54**

f. Emissions from Human Cremation

The following table lists county-total emissions by pollutant. Emissions are listed in tons per year. Counties without human crematories are not included in this table.

County	County Name	Number of Human Crematory Facilities	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
29001	ADAIR	1	0.0008	0.0056	0	0	0	0.0002
29009	BARRY	1	0.0052	0.0063	0.0054	0.0036	0.0038	0.0005
29015	BENTON	2	0.0171	1.7375	0.1141	0	0.265	0.0146
29019	BOONE	4	0.1516	0.1376	0.1176	0.0868	0.0872	0.0252
29021	BUCHANAN	2	0.3336	0.1575	0.2541	0.108	0.1212	0.2999
29023	BUTLER	1	0	0	0	0	0	0
29027	CALLAWAY	1	0	0	0.0123	0	0	0
29029	CAMDEN	1	0	0	0	0	0	0
29031	CAPE GIRARDEAU	1	0.0002	0	0.0003	0	0.0007	0
29071	FRANKLIN	1	0.0001	0.0123	0.0002	0	0.0012	0.0001
29077	GREENE	3	0.0057	0.1767	0.0617	0.0348	0.0513	0.0024
29091	HOWELL	1	0	0.0003	0.03	0	0.0001	0
29095	JACKSON	6	0.1152	0.457	0.9048	0.6919	0.5172	0.6599
29097	JASPER	4	0.0417	0.2651	0.0817	0.006	0.06	0.1914
29099	JEFFERSON	1	0.0199	0.024	0.0205	0	0.0146	0.002
29101	JOHNSON	1	0.0017	0.0374	0.0622	0.0212	0.0778	0.0059

County	County Name	Number of Human Crematory Facilities	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
29159	PETTIS	1	0.0583	0.0175	0.0151	0	0.0151	0.0175
29161	PHELPS	1	0.0148	0.0178	0.0152	0	0.0109	0.0015
29165	PLATTE	1	0.1008	0.1217	0.2024	0	0.0855	0.3488
29169	PULASKI	1	0.0116	0.0447	0.0771	0	0.0027	0.0671
29183	ST. CHARLES	4	0.2025	0.2446	0.2389	0.0001	0.1485	0.2066
29187	ST. FRANCOIS	3	0.0162	0.0268	0.033	0	0.0148	0.0563
29189	ST. LOUIS CO.	9	0.173	0.2089	0.178	0	0.127	0.0171
29207	STODDARD	1	0	0	0.0006	0	0	0
29209	STONE	1	0	0	0	0	0	0
29510	ST. LOUIS CITY	1	0.1062	0.1281	0.1682	0	0.0781	0.0107
Statewide Total Human Cremation			1.3762	3.8274	2.5934	0.9524	1.6827	1.9277

g. Emissions from Animal Cremation

The following table lists county-total emissions by pollutant. Counties without animal crematories are not included in this table. Emissions are in tons per year.

County	County Name	Number of Animal Crematory Facilities	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
29019	BOONE	2	0.2794	0.043	0.0708	0.0555	0.0311	0.1093
29031	CAPE GIRARDEAU	2	0.0532	0.095	0.118	0.023	0.1561	0.1803
29047	CLAY	2	0.1342	0.1619	0.2693	0.22	0.1137	0.4641
29049	CLINTON	1	0.0147	0.0178	0.0296	0.025	0.0125	0.051
29051	COLE	2	0.1369	0.0412	0.0645	0	0.0343	0.041
29053	COOPER	1	0.0002	0.0037	0.0006	0.0006	0.0007	0.0037
29095	JACKSON	4	2.0289	1.157	0.9072	0	0.9641	0.8858
29097	JASPER	3	0.1481	0.1725	0.0781	0	0.1389	0.2393
29099	JEFFERSON	1	0.3726	1.599	0.9173	0	1.3325	1.599
29101	JOHNSON	1	0.0039	0.0048	0.0062	0.0027	0.0029	0
29105	LACLEDE	1	0.0929	0.1121	0.1864	0	0.0787	0.3213
29117	LIVINGSTON	1	0.0029	0.0035	0.0059	0	0.0025	0.0102
29125	MARIES	1	0.0047	0.0056	0.0093	0	0.0039	0.0161
29149	OREGON	1	0.0022	0.0027	0.0023	0.0015	0.0016	0.0002
29155	PEMISCOT	1	0.001	0.0048	0.0015	0	0	0.0048
29159	PETTIS	1	0.0015	0.0189	0.0147	0	0.0147	0.0189
29161	PHELPS	3	0.0277	0.0335	0.0724	0	0.0233	0.0907
29165	PLATTE	1	0.0293	0.4295	0.0796	0	0.2343	0.1063
29167	POLK	1	0.0038	0.0046	0.0076	0	0.0032	0.0132
29169	PULASKI	1	0.0135	0.0163	0.0271	0	0.0099	0.0468
29183	ST. CHARLES	2	0.1841	0.2259	0.3716	0	0.1568	0.6402
29189	ST. LOUIS CO.	1	0.043	0.052	0.0443	0	0.0317	0.0043
29225	WEBSTER	1	0.0214	0.0258	0.0429	0	0.0181	0.074
29510	ST. LOUIS CITY	2	0.049	0.9529	0.4919	0	1.4762	1.941
Statewide Total Animal Cremation			**3.6491**	**5.184**	**3.8191**	**0.3283**	**4.8417**	**6.8615**

h. QA/QC

1. Number of facilities checked –outliers examined

One of the first sites examined was Logan College (29189-1114). The NO_x emissions from this site are over 4 tons. A closer look at the data revealed that natural gas combustion in space heaters contributed virtually all their NO_x emissions. This revelation led to the use of specific SCCs to obtain the cremation emissions in our tables. Site emissions include data which would overstate the cremation emission data. Therefore the process emissions were used via the SCC at specific sites which have the selected NAICS. Once the selection criteria were established, the data was reliable.

The emissions for each site are usually small so the sites which have large numbers stand out. Ten sites with the largest quantity of emissions were selected for a quality check. Emission factors, past years throughput and emission variances were quality checked. They were acceptable.

Further quality checks revealed two facilities used an unusually large throughput for their incinerator. They were submitting in the incorrect units (pounds or hours) of throughput when the questionnaire requires the throughput quantity in tons. They were corrected.

2. Compared to EPA estimate (statewide total table)

In the table below, the animal and human cremation emissions are combined. There are discrepancies between the emissions taken from the EPA website and the data from the Missouri EIQs.

Pollutant	**EPA Estimate Of Cremation** *(Emissions in Tons)*	**Missouri EIQ Cremation Data** *(Emissions in Tons)*
PM_{10}	1.34	6.41
SO_x	3.14	6.52
NO_x	20.38	9.01
VOC	.07	8.79
CO	.1	5.03
$PM_{2.5}$	1.34	1.28

EPA's emission estimate uses top-down information on mortality, population distribution, and emission factors that Missouri has not reviewed. Missouri's estimate comes from a bottom-up method, and uses published and vetted emission factors from AP-42 in most all cases. Missouri chooses to use state-specific inventory data for this category.

8.55 Asphalt Paving: Cutback

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Asphalt paving is the process of applying asphalt concrete to seal or repair the surface of roads, parking lots, driveways, walkways, or airport runways. Asphalt concrete is a composite material comprised of a binder and a mineral aggregate. The binder, referred to as asphalt cement, is a byproduct of petroleum refining and contains the semi-solid residual material left after the more volatile chemical fractions have been distilled off.[1]

Asphalt cements thinned with petroleum distillates are known as cutback asphalts. The primary uses of cutback asphalt include tack and seal operations, priming roadbeds, and paving operations for pavements up to several inches thick. Cut-back asphalt is produced by thinning the binder in a diluent containing 25 to 45 percent petroleum distillates by volume prior to mixing with the aggregate. This reduces the viscosity of the asphalt making it easier to work with the mixture.

Emissions from cutback asphalt result from the evaporation of VOCs and HAPS after the mixture is laid down. Of all asphalt types, cutback asphalt has the highest diluent content and, as a result, emits the highest levels of VOCs per ton used. The timeframe and quantity of VOC and HAP emissions depend on the type and the quantity of organic solvent used as a diluent.

For this source category, the following SCC was assigned:

SCC	**SCC Level 1**	**SCC Level 2**	**SCC Level 3**	**SCC Level 4**
2461021000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Cutback Asphalt	Total: All Solvent Types

The general approach to calculating emissions from cutback asphalt paving is to multiply the estimated county-level cutback asphalt usage by emission factors for VOCs and HAPs.

b. Activity Data

State-level cutback asphalt usage in 2008 was obtained from the Asphalt Institute's *2008 Asphalt Usage Survey*.[2] (the EPA used the same activity values for the 2011 as they did for the 2008 NEI due to limited

resources.) State-level data were allocated to county-level according to the fraction of paved road vehicle miles traveled (VMT) in each county.

Total annual VMT estimates by State and roadway class were obtained from the Federal Highway Administration's (FHWA) annual Highway Statistics report.[3] Paved road VMT was calculated by subtracting the State/roadway class unpaved road VMT from total State/roadway class VMT. State-level paved road VMT was spatially allocated to counties according to the fraction of total VMT in each county for the specific roadway class as shown by the following equation:

$$VMT_{x,total} = \sum VMT_{ST,y} * VMT_{x,y} / VMT_{ST,y}$$

where: $VMT_{x,total}$ = VMT (million miles) in county x on all paved roadways

$VMT_{ST,y}$ = paved road VMT for the entire State for roadway class y

$VMT_{x,y}$ = total VMT (million miles) in county x and roadway class y

$VMT_{ST,y}$ = total VMT (million miles) in entire State for roadway class y

The county-level total VMT by roadway class used in this calculation was previously developed by E.H. Pechan and Associates, Inc. to support the onroad national emissions inventory.[4]

c. Emission Factors

Emission factors for cutback asphalt usage were obtained from the *Technical Report Series* produced by the U.S. EPA's Emission Inventory Improvement Program and are reported in the corresponding table below.[1]

d. Emissions

Emissions were calculated by multiplying the county-level asphalt usage (barrels) by the emission factors listed in the corresponding table below and then dividing by 2000 to convert pounds to tons.

$$Emissions_{x,y} = (Asphalt\ Usage_x * EF_y) / 2000$$

where: $Emissions_{x,y}$ = emissions (tons) of pollutant y in county x

$Asphalt\ Usage_x$ = cutback asphalt (barrels) used in county x

EF_y = emission factor for pollutant y

To convert tons of asphalt reported in the *2008 Asphalt Usage Survey* to barrels, it was assumed that the density of asphalt is similar to that of water, 8.34 lbs/gal, and that one barrel equals 42 gallons.

Barrels of Asphalt = (tons of asphalt * 2000 lbs / 8.34 lbs/gal) / 42 gal/barrel

Note that one barrel of asphalt weights approximately 350 pounds.

e. Sample Calculation

VOC emissions from cutback asphalt usage in Autauga County, Alabama:

From the *2008 Asphalt Usage Survey*, the state of Alabama used 1,728 tons of cutback asphalt in 2008. The fraction of paved road VMT traveled in Autauga County is 497 million miles divided by 53,633 million miles which equals 0.0093.

$\text{Asphalt Usage}_{\text{Autauga}}$ = ((1,728 tons * 2000 lbs / 8.34 lbs/gal) / 42 gal/barrel) * 0.0093

$\text{Asphalt Usage}_{\text{Autauga}}$ = 91.41 barrels

$\text{VOC Emissions}_{\text{Autauga}}$ = (91.41 barrels * 88 lbs/barrel) / 2000 lbs/ton

$\text{VOC Emissions}_{\text{Autauga}}$ = 4.022 tons

Criteria and HAP Emission Factors for Cutback Asphalt Paving

Pollutant Description	Pollutant Code	Emission Factor (LBS/BARREL)	Emission Factor Reference
VOLATILE ORGANIC COMPOUNDS	VOC	88.00	1
ETHYL BENZENE	100414	2.02	1
TOLUENE	108883	5.63	1
XYLENES (MIXTURE OF O, M, AND P	1330207	10.74	1

f. References

1. U.S. Environmental Protection Agency, Emissions Inventory Improvement Program, *Technical Report Series*, Volume III – Area Sources, Chapter 17, "Asphalt Paving," prepared by Eastern Research Group, Inc. for EPA, Research Triangle Park, NC, 2001. Available at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html.

2. Asphalt Institute, *2008 Asphalt Usage Survey for the United States and Canada*, http://www.asphaltinstitute.org/.

3. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007,*

Office of Highway Policy Information, Washington, DC, 2008. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2007/.

4. E.H. Pechan & Associates, Inc. "Documentation for the Onroad National Emission Inventory (NEI) for Base Years 1970 - 2002," report prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2004.

8.56 Asphalt Paving: Emulsified

The Missouri DNR accepted EPA's estimates of emissions for this source category. The documentation below was developed by EPA.

a. Source Category Description

Asphalt paving is the process of applying asphalt concrete to seal or repair the surface of roads, parking lots, driveways, walkways, or airport runways. Asphalt concrete is a composite material comprised of a binder and a mineral aggregate. The binder, referred to as asphalt cement, is a byproduct of petroleum refining and contains the semi-solid residual material left after the more volatile chemical fractions have been distilled off.[1]

Asphalt cements thinned with water and an emulsifying agent are known as emulsified asphalts. This thinning reduces the viscosity of the asphalt making it easier to work with the mixture. The primary uses of emulsified asphalt include tack and seal operations, priming roadbeds, and paving operations for pavements up to several inches thick.

Emulsified asphalt may contain up to 12 percent organic solvents by volume.[1] Emissions from emulsified asphalt result from the evaporation of VOCs after the mixture is laid down. Compared to cutback asphalt, emulsified asphalt has lower VOCs emissions per ton used.

For this source category, the following SCC was assigned:

SCC	SCC Level 1	SCC Level 2	SCC Level 3	SCC Level 4
2461022000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Emulsified Asphalt	Total: All Solvent Types

The general approach to calculating emissions from emulsified asphalt paving is to multiply the estimated county-level emulsified asphalt usage by emission factors for VOCs.

b. Activity Data

State-level emulsified asphalt usage in 2008 was obtained from the Asphalt Institute's *2008 Asphalt Usage Survey*.[2] (the EPA used the same activity values for the 2011 as they did for the 2008 NEI due to

limited resources.) State-level data were allocated to county-level according to the fraction of paved road vehicle miles traveled (VMT) in each county.

Total annual VMT estimates by State and roadway class were obtained from the Federal Highway Administration's (FHWA) annual Highway Statistics report.[3] Paved road VMT was calculated by subtracting the State/roadway class unpaved road VMT from total State/roadway class VMT. State-level paved road VMT was spatially allocated to counties according to the fraction of total VMT in each county for the specific roadway class as shown by the following equation:

$$VMT_{x,total} = \sum VMT_{ST,y} * VMT_{x,y} / VMT_{ST,y}$$

where: $VMT_{x,total}$ = VMT (million miles) in county x on all paved roadways

$VMT_{ST,y}$ = paved road VMT for the entire State for roadway class y

$VMT_{x,y}$ = total VMT (million miles) in county x and roadway class y

$VMT_{ST,y}$ = total VMT (million miles) in entire State for roadway class y

The county-level total VMT by roadway class used in this calculation was previously developed by E.H. Pechan and Associates, Inc. to support the onroad national emissions inventory.[4]

c. Emission Factors

Emission factors for emulsified asphalt usage were obtained from the *Technical Report Series* produced by the U.S. EPA's Emission Inventory Improvement Program and are reported in the corresponding table below.[1]

d. Emissions

Emissions were calculated by multiplying the county-level asphalt usage (barrels) by the emission factors listed in the corresponding table below and then dividing by 2000 to convert pounds to tons.

$$Emissions_{x,y} = (Asphalt\ Usage_x * EF_y) / 2000$$

where: $Emissions_{x,y}$ = emissions (tons) of pollutant y in county x

$Asphalt\ Usage_x$ = emulsified asphalt (barrels) used in county x

EF_y = emission factor for pollutant y

To convert tons of asphalt reported in the *2008 Asphalt Usage Survey* to barrels, it was assumed that the density of asphalt is similar to that of water, 8.34 lbs/gal, and that one barrel equals 42 gallons.

Barrels of Asphalt = (tons of asphalt * 2000 lbs / 8.34 lbs/gal) / 42 gal/barrel

Note that one barrel of asphalt weights approximately 350 pounds.

e. Sample Calculation

VOC emissions from emulsified asphalt usage in Autauga County, Alabama:

From the *2008 Asphalt Usage Survey*, the state of Alabama used 18,988 tons of emulsified asphalt in 2008. The fraction of paved road VMT traveled in Autauga County is 497 million miles divided by 53,633 million miles which equals 0.0093.

Asphalt Usage$_{Autauga}$ = ((18,988 tons * 2000 lbs / 8.34 lbs/gal) / 42 gal/barrel) * 0.0093

Asphalt Usage$_{Autauga}$ = 1,004 barrels

VOC Emissions$_{Autauga}$ = (1,004 barrels * 9.2 lbs/barrel) / 2000 lbs/ton

VOC Emissions$_{Autauga}$ = 4.62 tons

Criteria Emission Factors for Emulsified Asphalt Paving

Pollutant Description	Pollutant Code	Emission Factor (LBS/BARREL)	Emission Factor Reference
VOLATILE ORGANIC COMPOUNDS	VOC	9.2	1

f. References

5. U.S. Environmental Protection Agency, Emissions Inventory Improvement Program, *Technical Report Series*, Volume III – Area Sources, Chapter 17, "Asphalt Paving," prepared by Eastern Research Group, Inc. for EPA, Research Triangle Park, NC, 2001. Available at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html.

6. Asphalt Institute, *2008 Asphalt Usage Survey for the United States and Canada*, http://www.asphaltinstitute.org/.

7. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007,*

Office of Highway Policy Information, Washington, DC, 2008. Available at http://www.fhwa.dot.gov/policyinformation/statistics/2007/.

8. E.H. Pechan & Associates, Inc. "Documentation for the Onroad National Emission Inventory (NEI) for Base Years 1970 - 2002," report prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2004.

8.57 Miscellaneous Mercury: Lamp Breakage, Health, Dental

The Missouri DNR accepted EPA's estimates of emissions for this source category. EPA pulled these estimates forward from previous inventories like the 1999 and 2002 NEI's.

8.58 Oil and Gas Production

CenSARA contracted with Environ to survey oil and gas producers to improve emission estimates for nonpoint oil and gas production. Environ subcontracted with Transsystems to create the emission calculation tool and EIS staging tables for states to use in 2011. The tool is updatable for future years and improved data sources.

The tool is fully described in the Environ report "2011 Oil and Gas Emission Inventory Enhancement Project for CenSARA States", Dec 21, 2012, attached as Appendix B-4. It roughly covers: sixteen CAP, HAP and GHG pollutants for all 115 Missouri counties for 16 SCCs. Missouri only has oil and gas activity for five counties, and their emissions of CAP are listed below:

State And County FIPS Code	County Name	CO	NO_x	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	VOC
29005	Atchison	5.536111	3.922423	0.084068	0.084068	0.000827	9.183114
29037	Cass	10.38051	7.3546	0.157627	0.157627	0.001551	21.04987
29095	Jackson	3.460204	2.45154	0.052542	0.052542	0.000517	7.472651
29177	Ray	0.691992	0.490299	0.010508	0.010508	0.000103	0.867738
29217	Vernon	3.391025	2.488806	0.065422	0.065422	1.565628	18.85303
Statewide Total		23.45984	16.70767	0.370168	0.370168	1.568627	57.42641

Missouri has no point source contribution to this category, and the contractor-provided emissions are accepted.

Missouri did remove values from the "ControlApproach", "ControlPollutant", and "ControlMeasure" table as these tables were causing an XML schema problem that could not be corrected. Missouri does not believe that this removal materially affects the emission report.

Table 4 displays the 2011 nonpoint emissions by county for the entire state. Table 5 displays the statewide nonpoint emissions by SCC.

Table 4 Nonpoint Source Emissions by County (tons per year)

FIPS	County Name	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
29001	Adair	0.00	525	372	57	4,642	693	4	422
29003	Andrew	0.00	336	457	28	4,804	684	2	451
29005	Atchison	0.00	141	896	18	4,588	768	1	474
29007	Audrain	0.00	451	1,590	61	9,225	1,594	4	664
29009	Barry	0.00	980	5,093	127	8,857	1,110	12	614
29011	Barton	0.00	250	1,711	31	5,731	950	2	389
29013	Bates	0.00	395	1,876	37	7,362	1,141	2	506
29015	Benton	0.00	481	1,168	34	5,960	769	3	398
29017	Bollinger	0.00	323	255	22	5,177	710	2	208
29019	Boone	0.00	2,419	537	313	12,053	1,742	15	2,427
29021	Buchanan	0.00	1,278	561	290	5,493	894	21	1,445
29023	Butler	0.00	1,055	1,309	101	9,865	1,437	10	902
29025	Caldwell	0.00	249	547	20	5,228	792	2	241
29027	Callaway	0.00	1,026	1,048	99	10,890	1,483	16	945
29029	Camden	0.00	1,241	285	78	10,874	1,346	6	786
29031	Cape Girardeau	0.00	1,944	916	194	10,724	1,593	11	1,370
29033	Carroll	0.00	186	972	24	7,575	1,361	1	385
29035	Carter	0.00	187	73	13	2,095	259	1	141
29037	Cass	0.00	1,960	1,336	189	13,059	1,840	13	1,563
29039	Cedar	0.00	330	597	29	3,601	450	2	240
29041	Chariton	0.00	195	1,072	17	9,126	1,620	1	374
29043	Christian	0.00	2,310	502	148	12,755	1,669	9	1,268
29045	Clark	0.00	196	542	17	5,741	961	1	270
29047	Clay	0.00	3,418	285	515	8,968	1,581	27	2,725
29049	Clinton	0.00	462	1,214	40	6,151	822	3	457
29051	Cole	0.00	1,871	824	174	8,828	1,257	14	1,130
29053	Cooper	0.00	357	1,336	36	4,474	666	2	527
29055	Crawford	0.00	687	235	68	6,051	752	7	674
29057	Dade	0.00	200	794	17	3,688	530	1	223
29059	Dallas	0.00	382	720	28	4,504	546	2	263
29061	Daviess	0.00	192	1,480	17	4,654	706	2	344
29063	DeKalb	0.00	209	495	19	3,624	519	1	299
29065	Dent	0.00	368	203	31	3,597	453	4	235
29067	Douglas	0.00	316	405	30	3,549	436	3	236
29069	Dunklin	0.00	579	1,629	70	11,681	1,941	3	1,018
29071	Franklin	0.00	2,599	1,265	227	20,294	2,664	37	1,469
29073	Gasconade	0.00	383	516	40	4,348	560	5	427
29075	Gentry	0.00	161	1,497	17	3,513	525	1	212
29077	Greene	0.00	4,172	700	672	17,584	2,515	32	4,064
29079	Grundy	0.00	203	612	28	3,549	597	2	265

FIPS	County Name	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
29081	Harrison	0.00	189	879	21	4,729	786	1	344
29083	Henry	0.00	504	1,015	59	6,421	1,017	6	644
29085	Hickory	0.00	252	263	17	3,189	388	1	172
29087	Holt	0.00	105	596	12	4,693	806	1	371
29089	Howard	0.00	211	421	22	3,463	532	2	250
29091	Howell	0.00	1,031	759	105	9,658	1,194	13	661
29093	Iron	0.99	267	88	19	2,695	336	1	153
29095	Jackson	0.01	10,472	496	1,811	17,064	3,640	90	9,159
29097	Jasper	0.00	2,230	1,551	334	12,303	1,846	22	1,978
29099	Jefferson	0.00	5,537	175	369	24,220	3,284	35	3,158
29101	Johnson	0.00	976	1,496	100	10,515	1,444	19	893
29103	Knox	0.00	103	653	9	3,264	538	1	243
29105	Laclede	0.00	918	739	103	7,425	950	11	787
29107	Lafayette	0.00	691	1,776	73	8,988	1,327	5	909
29109	Lawrence	0.00	751	2,535	79	7,844	1,003	6	666
29111	Lewis	0.00	248	664	24	5,329	798	2	314
29113	Lincoln	0.00	1,233	863	89	15,713	2,113	16	909
29115	Linn	0.00	271	569	38	4,363	663	3	318
29117	Livingston	0.00	299	556	37	5,979	1,062	2	397
29119	McDonald	0.00	709	2,673	79	7,652	928	10	413
29121	Macon	0.00	345	1,162	35	6,057	945	2	384
29123	Madison	0.00	408	299	26	2,743	351	2	209
29125	Maries	0.00	242	517	17	3,192	399	2	168
29127	Marion	0.00	556	1,561	75	6,171	1,084	4	648
29129	Mercer	0.00	88	364	8	2,223	344	1	121
29131	Miller	0.00	683	2,436	45	6,707	837	4	434
29133	Mississippi	0.00	263	1,636	29	6,916	1,273	1	512
29135	Moniteau	0.00	293	1,996	32	3,544	502	2	392
29137	Monroe	0.00	245	1,163	21	5,320	829	2	319
29139	Montgomery	0.00	324	858	27	4,707	694	2	479
29141	Morgan	0.00	516	2,682	38	6,858	834	3	371
29143	New Madrid	0.00	391	2,936	53	14,357	2,608	4	955
29145	Newton	0.00	1,373	3,906	139	12,812	1,617	11	960
29147	Nodaway	0.00	408	1,466	62	6,438	1,040	6	689
29149	Oregon	0.00	261	353	21	2,905	359	2	200
29151	Osage	0.00	334	1,775	34	4,998	638	7	271
29153	Ozark	0.00	261	415	20	3,182	386	2	380
29155	Pemiscot	0.00	332	1,873	48	9,011	1,578	3	827
29157	Perry	0.00	498	589	71	4,830	700	8	447
29159	Pettis	0.00	869	2,756	133	7,993	1,227	15	827
29161	Phelps	0.00	1,097	263	85	7,190	933	7	878
29163	Pike	0.00	364	2,194	38	6,568	1,067	3	506
29165	Platte	0.00	1,422	639	194	6,528	1,054	10	1,566
29167	Polk	0.00	690	1,802	51	7,287	907	4	521

FIPS	County Name	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
29169	Pulaski	0.00	1,198	511	72	7,971	1,024	5	693
29171	Putnam	0.00	140	903	13	2,261	322	1	150
29173	Ralls	0.00	249	591	43	5,686	877	7	443
29175	Randolph	0.00	466	507	58	5,500	820	4	485
29177	Ray	0.00	508	625	50	8,992	1,336	3	458
29179	Reynolds	0.58	170	70	13	2,232	271	1	161
29181	Ripley	0.00	374	633	31	5,092	651	3	228
29183	St. Charles	0.00	4,727	900	627	14,500	2,598	34	4,792
29185	St. Clair	0.00	231	478	20	5,056	758	2	296
29186	Ste. Genevieve	0.00	521	829	49	5,078	659	5	404
29187	St. Francois	0.00	1,703	405	127	9,144	1,205	11	941
29189	St. Louis	0.01	14,585	718	2,681	24,594	5,315	142	16,228
29195	Saline	0.00	445	1,912	74	10,246	1,792	5	671
29197	Schuyler	0.00	109	261	8	1,910	265	1	112
29199	Scotland	0.00	119	702	12	3,703	612	1	212
29201	Scott	0.00	727	3,095	96	8,912	1,395	6	864
29203	Shannon	0.00	210	155	18	2,738	329	2	186
29205	Shelby	0.00	193	1,330	17	6,172	1,065	1	336
29207	Stoddard	0.00	746	4,368	93	14,529	2,376	12	1,101
29209	Stone	0.00	1,122	431	62	9,719	1,189	4	548
29211	Sullivan	0.00	176	3,276	31	2,745	376	3	161
29213	Taney	0.00	2,864	113	137	9,701	1,352	10	920
29215	Texas	0.00	667	889	51	8,436	1,016	5	560
29217	Vernon	0.00	438	3,931	54	8,342	1,367	5	589
29219	Warren	0.00	953	648	57	8,485	1,183	5	664
29221	Washington	0.00	571	185	38	6,525	783	4	370
29223	Wayne	0.00	343	147	28	4,596	565	2	257
29225	Webster	0.00	870	1,087	62	9,109	1,136	6	698
29227	Worth	0.00	53	253	5	1,265	194	0	101
29229	Wright	0.00	443	2,031	38	4,860	607	3	353
29510	St. Louis city	0.00	4,955	148	1,062	4,920	1,429	52	5,095

Table 5 Nonpoint Source Emissions by SCC (tons per year)

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2302002200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Under-fired Charbroiling		404			1,056	1,056		124
2302003100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Flat Griddle Frying		38			309	309		18
2302002100	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Charbroiling	Conveyorized Charbroiling		127			149	149		36
2103008000	Stationary Source Fuel Combustion	Commercial/Institutional	Wood	Total: All Boiler Types		840	7	308	724	626	35	24
2302003200	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Clamshell Griddle Frying					21	21		1
2102008000	Stationary Source Fuel Combustion	Industrial	Wood	Total: All Boiler Types		667	8	244	575	497	28	19
2104006000	Stationary Source Fuel Combustion	Residential	Natural Gas	Total: All Combustor Types		2,148	1,074	5,047	28	23	32	295
2103006000	Stationary Source Fuel Combustion	Commercial/Institutional	Natural Gas	Total: Boilers and IC Engines	0.01	2,185	13	2,601	14	11	16	143
2102006000	Stationary Source Fuel Combustion	Industrial	Natural Gas	Total: Boilers and IC Engines	0.01	994	38	1,183	6	5	7	65
2104007000	Stationary Source Fuel Combustion	Residential	Liquified Petroleum Gas (LPG)	Total: All Combustor Types		389	5	1,370	5	4	6	53
2102004001	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All Boiler Types	0.00	7	1	30	3	2	63	0

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2102004002	Stationary Source Fuel Combustion	Industrial	Distillate Oil	All IC Engine Types	0.00	193	0	896	65	61	59	0
2104004000	Stationary Source Fuel Combustion	Residential	Distillate Oil	Total: All Combustor Types	0.00	3	1	12	2	1	29	0
2104011000	Stationary Source Fuel Combustion	Residential	Kerosene	Total: All Heater Types	0.00	3	1	12	2	1	28	0
2102005000	Stationary Source Fuel Combustion	Industrial	Residual Oil	Total: All Boiler Types	0.00	2	0	25	10	7	160	0
2103004001	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	Boilers	0.00	1	0	5	1	1	12	0
2103004002	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	IC Engines	0.01	35	0	164	12	12	11	0
2102011000	Stationary Source Fuel Combustion	Industrial	Kerosene	Total: All Boiler Types	0.00	1	0	3	0	0	6	0
2103011000	Stationary Source Fuel Combustion	Commercial/Institutional	Kerosene	Total: All Combustor Types	0.00	0	0	2	0	0	4	0
2103005000	Stationary Source Fuel Combustion	Commercial/Institutional	Residual Oil	Total: All Boiler Types	0.00	0	0	4	1	1	29	0
2102007000	Stationary Source Fuel Combustion	Industrial	Liquified Petroleum Gas (LPG)	Total: All Boiler Types		31	1	56	0	0	0	2

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2103007000	Stationary Source Fuel Combustion	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	0.00	17	0	30	0	0	0	1
2102001000	Stationary Source Fuel Combustion	Industrial	Anthracite Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2102002000	Stationary Source Fuel Combustion	Industrial	Bituminous/Subbituminous Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2103001000	Stationary Source Fuel Combustion	Commercial/Institutional	Anthracite Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2103002000	Stationary Source Fuel Combustion	Commercial/Institutional	Bituminous/Subbituminous Coal	Total: All Boiler Types	-	-	-	-	-	-	-	-
2104001000	Stationary Source Fuel Combustion	Residential	Anthracite Coal	Total: All Combustor Types		-	-	-	-	-	-	-
2104002000	Stationary Source Fuel Combustion	Residential	Bituminous/Subbituminous Coal	Total: All Combustor Types		-	-	-	-	-	-	-
2104005000	Stationary Source Fuel Combustion	Residential	Residual Oil	Total: All Combustor Types	-	-	-	-	-	-	-	-
2104008100	Stationary Source Fuel Combustion	Residential	Wood	Fireplace: general		27,657	334	483	4,381	4,381	74	3,508
2104008210	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; non-EPA certified		20,347	150	247	2,698	2,698	35	4,672

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2104008220	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; non-catalytic		3,959	25	64	551	551	11	337
2104008230	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: fireplace inserts; EPA certified; catalytic		979	8	19	191	191	4	141
2104008310	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, non-EPA certified		18,633	137	226	2,470	2,470	32	4,279
2104008320	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, non-catalytic		3,627	23	59	505	505	10	309
2104008330	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: freestanding, EPA certified, catalytic		896	8	17	175	175	3	129
2104008400	Stationary Source Fuel Combustion	Residential	Wood	Woodstove: pellet-fired, general (freestanding or FP insert)		222	4	53	43	43	4	1
2104008510	Stationary Source Fuel Combustion	Residential	Wood	Furnace: Indoor, cordwood-fired, non-EPA certified		2,445	24	25	368	368	27	157
2104008610	Stationary Source Fuel Combustion	Residential	Wood	Hydronic heater: outdoor		6,062	30	31	1,078	1,078	34	1,135
2104008700	Stationary Source Fuel Combustion	Residential	Wood	Outdoor wood burning device, NEC (fire-pits, chimeas, etc)		88	1	2	14	14	0	11

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2104009000	Stationary Source Fuel Combustion	Residential	Firelog	Total: All Combustor Types		596		37	140	135		188
2294000000	Mobile Sources	Paved Roads	All Paved Roads	Total: Fugitives					38,189	9,547		
2296000000	Mobile Sources	Unpaved Roads	All Unpaved Roads	Total: Fugitives					539,143	53,741		
2302003000	Industrial Processes	Food and Kindred Products: SIC 20	Commercial Cooking - Frying	Deep Fat Fying								38
2306000000	Industrial Processes	Petroleum Refining: SIC 29	All Processes	Total	0.00	499		214	266	12	139	142
2310000220	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Drill Rigs		-		-	-	-	-	-
2310000330	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Artificial Lift		21		13	0	0	0	0
2310000550	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Produced Water								-
2310000660	Industrial Processes	Oil and Gas Exploration and Production	All Processes	Hydraulic Fracturing Engines		-		-	-	-	-	-
2310010100	Industrial Processes	Oil and Gas Exploration and Production	Crude Petroleum	Oil Well Heaters		3		3	0	0	0	0
2310010200	Industrial Processes	Oil and Gas Exploration and Production	Crude Petroleum	Oil Well Tanks - Flashing & Standing/Working/Breathing		0		0			0	25

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310010300	Industrial Processes	Oil and Gas Exploration and Production	Crude Petroleum	Oil Well Pneumatic Devices								21
2310011000	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Total: All Processes		0		0			1	3
2310011201	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Tank Truck/Railcar Loading: Crude Oil								0
2310011501	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Connectors								2
2310011502	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Flanges								0
2310011503	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Open Ended Lines								0
2310011505	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Production	Fugitives: Valves								4
2310021010	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Storage Tanks: Condensate		-		-			-	-
2310021030	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Tank Truck/Railcar Loading: Condensate								-
2310021100	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Heaters		-		-	-	-	-	-

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310021202	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP		-		-	-	-	-	-
2310021209	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Total: All Natural Gas Fired 4Cycle Lean Burn Compressor Engines		-		-	-	-	-	-
2310021251	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Lateral Compressors 4 Cycle Lean Burn		-		-	-	-	-	-
2310021300	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Pneumatic Devices								-
2310021302	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP		-		-	-	-	-	-
2310021309	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Total: All Natural Gas Fired 4Cycle Rich Burn Compressor Engines		-		-	-	-	-	-
2310021351	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Lateral Compressors 4 Cycle Rich Burn		-		-	-	-	-	-
2310021400	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Dehydrators		-		-	-	-	-	-
2310021501	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Connectors								-

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310021502	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Flanges								-
2310021503	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Open Ended Lines								-
2310021505	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Valves								-
2310021506	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Fugitives: Other								-
2310021603	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Production	Gas Well Venting - Blowdowns		-		-			-	-
2310111100	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Exploration	Mud Degassing								-
2310111401	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Exploration	Oil Well Pneumatic Pumps								2
2310111700	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Oil Exploration	Oil Well Completion: All Processes		-		-			-	-
2310121100	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Exploration	Mud Degassing								-
2310121401	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Exploration	Gas Well Pneumatic Pumps								-

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2310121700	Industrial Processes	Oil and Gas Exploration and Production	On-Shore Gas Exploration	Gas Well Completion: All Processes		-		-			-	-
2311010000	Industrial Processes	Construction: SIC 15 - 17	Residential	Total					618	62		
2311020000	Industrial Processes	Construction: SIC 15 - 17	Industrial/Commercial/Institutional	Total					24,459	2,446		
2311030000	Industrial Processes	Construction: SIC 15 - 17	Road Construction	Total					20,137	2,014		
2325000000	Industrial Processes	Mining and Quarrying: SIC 14	All Processes	Total					1,243	65		
2325060000	Industrial Processes	Mining and Quarrying: SIC 10	Lead Ore Mining and Milling	Total	1.57							
2401001000	Solvent Utilization	Surface Coating	Architectural Coatings	Total: All Solvent Types								7,007
2401005000	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Total: All Solvent Types								1,459
2401008000	Solvent Utilization	Surface Coating	Traffic Markings	Total: All Solvent Types								19
2401015000	Solvent Utilization	Surface Coating	Factory Finished Wood: SIC 2426 thru 242	Total: All Solvent Types								136
2401020000	Solvent Utilization	Surface Coating	Wood Furniture: SIC 25	Total: All Solvent Types								819
2401025000	Solvent Utilization	Surface Coating	Metal Furniture: SIC 25	Total: All Solvent Types								277
2401030000	Solvent Utilization	Surface Coating	Paper: SIC 26	Total: All Solvent Types								85
2401040000	Solvent Utilization	Surface Coating	Metal Cans: SIC 341	Total: All Solvent Types								130
2401055000	Solvent Utilization	Surface Coating	Machinery and Equipment: SIC 35	Total: All Solvent Types								311

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2401060000	Solvent Utilization	Surface Coating	Large Appliances: SIC 363	Total: All Solvent Types								1
2401065000	Solvent Utilization	Surface Coating	Electronic and Other Electrical: SIC 36 - 363	Total: All Solvent Types								21
2401070000	Solvent Utilization	Surface Coating	Motor Vehicles: SIC 371	Total: All Solvent Types								568
2401075000	Solvent Utilization	Surface Coating	Aircraft: SIC 372	Total: All Solvent Types								4
2401080000	Solvent Utilization	Surface Coating	Marine: SIC 373	Total: All Solvent Types								35
2401085000	Solvent Utilization	Surface Coating	Railroad: SIC 374	Total: All Solvent Types								22
2401090000	Solvent Utilization	Surface Coating	Miscellaneous Manufacturing	Total: All Solvent Types								421
2401100000	Solvent Utilization	Surface Coating	Industrial Maintenance Coatings	Total: All Solvent Types								1,806
2401200000	Solvent Utilization	Surface Coating	Other Special Purpose Coatings	Total: All Solvent Types								192
2415000000	Solvent Utilization	Degreasing	All Processes/All Industries	Total: All Solvent Types								3,263
2420000000	Solvent Utilization	Dry Cleaning	All Processes	Total: All Solvent Types								157
2425000000	Solvent Utilization	Graphic Arts	All Processes	Total: All Solvent Types								1,206
2460100000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Personal Care Products	Total: All Solvent Types								5,689

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2460200000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Household Products	Total: All Solvent Types								5,390
2460400000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Automotive Aftermarket Products	Total: All Solvent Types								4,072
2460500000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Coatings and Related Products	Total: All Solvent Types								2,845
2460600000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All Adhesives and Sealants	Total: All Solvent Types								1,707
2460800000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	All FIFRA Related Products	Total: All Solvent Types								5,330
2460900000	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial	Miscellaneous Products (Not Otherwise Covered)	Total: All Solvent Types								210
2461021000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Cutback Asphalt	Total: All Solvent Types								1,855
2461022000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Emulsified Asphalt	Total: All Solvent Types								970

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2461850001	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Corn								3,523
2461850002	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Apples								1
2461850003	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Grapes								0
2461850004	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Potatoes								6
2461850005	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Soy Beans								5,773
2461850006	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Hay & Grains								551
2461850009	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Not Elsewhere Classified								743
2461850051	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Corn								20
2461850052	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Apples								14
2461850053	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Grapes								0

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2461850054	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Potatoes								199
2461850055	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Soy Beans								10
2461850056	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Hay & Grains								10
2461850099	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Not Elsewhere Classified								408
2501011011	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Permeation								1,261
2501011012	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Evaporation (includes Diurnal losses)								2,462
2501011013	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Spillage During Transport								287
2501011014	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Vapor Displacement								97
2501011015	Storage and Transport	Petroleum and Petroleum Product Storage	Residential Portable Gas Cans	Refilling at the Pump - Spillage								8
2501012011	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Permeation								40

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2501012012	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Evaporation (includes Diurnal losses)								79
2501012013	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Spillage During Transport								392
2501012014	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Vapor Displacement								188
2501012015	Storage and Transport	Petroleum and Petroleum Product Storage	Commercial Portable Gas Cans	Refilling at the Pump - Spillage								15
2501050120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Terminals: All Evaporative Losses	Gasoline								754
2501055120	Storage and Transport	Petroleum and Petroleum Product Storage	Bulk Plants: All Evaporative Losses	Gasoline								879
2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling								53
2501060052	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Splash Filling								17,343
2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling								56
2501060101	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Displacement Loss/Uncontrolled								2,391

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2501060102	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Displacement Loss/Controlled								36
2501060103	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Spillage								928
2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying								1,617
2501070100	Storage and Transport	Petroleum and Petroleum Product Storage	Diesel Service Stations	Stage 2: Total								237
2501080050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 1: Total	0.01							571
2501080100	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 2: Total	0.00							30
2505030120	Storage and Transport	Petroleum and Petroleum Product Transport	Truck	Gasoline								97
2505040120	Storage and Transport	Petroleum and Petroleum Product Transport	Pipeline	Gasoline								1,120
2610000100	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Leaf Species Unspecified		327		18	64	50	2	82

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2610000400	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Brush Species Unspecified		409		15	58	44	5	55
2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)		13,555		401	1,364	1,051		931
2610030000	Waste Disposal, Treatment, and Recovery	Open Burning	Residential	Household Waste (use 26-10-000-xxx for Yard Wastes)		6,734		475	3,010	2,757	79	678
2630020000	Waste Disposal, Treatment, and Recovery	Wastewater Treatment	Public Owned	Total Processed			16					83
2801000003	Miscellaneous Area Sources	Agriculture Production - Crops	Agriculture - Crops	Tilling					187,393	37,478		
2801700001	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Anhydrous Ammonia			7,335					
2801700002	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Aqueous Ammonia			-					
2801700003	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Nitrogen Solutions			5,974					
2801700004	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Urea			20,775					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2801700005	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Nitrate			1,208					
2801700006	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Sulfate			979					
2801700007	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Ammonium Thiosulfate			38					
2801700010	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	N-P-K (multi-grade nutrient fertilizers)			309					
2801700011	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Calcium Ammonium Nitrate			0					
2801700012	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Potassium Nitrate			-					
2801700013	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Diammonium Phosphate			2,362					
2801700014	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Monoammonium Phosphate			658					
2801700015	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Liquid Ammonium Polyphosphate			80					
2801700099	Miscellaneous Area Sources	Agriculture Production - Crops	Fertilizer Application	Miscellaneous Fertilizers			3,353					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805001100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Confinement			1,009					
2805001200	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Manure handling and storage			0					
2805001300	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on feedlots (drylots)	Land application of manure			767					
2805002000	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle production composite	Not Elsewhere Classified			10,939					
2805003100	Miscellaneous Area Sources	Agriculture Production - Livestock	Beef cattle - finishing operations on pasture/range	Confinement			9,665					
2805007100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Confinement			3,206					
2805007300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - layers with dry manure management systems	Land application of manure			74					
2805009100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Confinement			5,110					
2805009200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Manure handling and storage			929					
2805009300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - broilers	Land application of manure			4,181					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805010100	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Confinement			4,286					
2805010200	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Manure handling and storage			771					
2805010300	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry production - turkeys	Land application of manure			3,854					
2805018000	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle composite	Not Elsewhere Classified			1,259					
2805019100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Confinement			26					
2805019200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Manure handling and storage			74					
2805019300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - flush dairy	Land application of manure			7					
2805021100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Confinement			686					
2805021200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Manure handling and storage			930					
2805021300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - scrape dairy	Land application of manure			1,154					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805022100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Confinement			100					
2805022200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Manure handling and storage			5					
2805022300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - deep pit dairy	Land application of manure			58					
2805023100	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Confinement			458					
2805023200	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Manure handling and storage			8					
2805023300	Miscellaneous Area Sources	Agriculture Production - Livestock	Dairy cattle - drylot/pasture dairy	Land application of manure			611					
2805030000	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Not Elsewhere Classified (see also 28-05-007, -008, -009)			710					
2805030007	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Ducks			20					
2805030008	Miscellaneous Area Sources	Agriculture Production - Livestock	Poultry Waste Emissions	Geese			6					
2805035000	Miscellaneous Area Sources	Agriculture Production - Livestock	Horses and Ponies Waste Emissions	Not Elsewhere Classified			2,005					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2805039100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Confinement			7,739					
2805039200	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Manure handling and storage			14,188					
2805039300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - operations with lagoons (unspecified animal age)	Land application of manure			1,210					
2805040000	Miscellaneous Area Sources	Agriculture Production - Livestock	Sheep and Lambs Waste Emissions	Total			269					
2805045000	Miscellaneous Area Sources	Agriculture Production - Livestock	Goats Waste Emissions	Not Elsewhere Classified			672					
2805047100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Confinement			1,735					
2805047300	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - deep-pit house operations (unspecified animal age)	Land application of manure			726					
2805053100	Miscellaneous Area Sources	Agriculture Production - Livestock	Swine production - outdoor operations (unspecified animal age)	Confinement			35					

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Lead	CO	NH_3	NO_X	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
2810060100	Miscellaneous Area Sources	Other Combustion	Cremation	Humans	0.01	1		2	2	1	1	1
2810060200	Miscellaneous Area Sources	Other Combustion	Cremation	Animals		4		5	4	0	5	7

9.0 Mobile Source Inventory

9.1 Onroad Inventory

EPA's MOVES model, version 2010b, was used to estimate total annual onroad emissions by county for Missouri. The 115 Missouri MOVES county input databases were updated with local activity data. These updates more accurately reflect Missouri emissions than the default data in the 2011 County Databases provided by EPA. The Air Program updated the following Input Tables:

- hpmsvtypeyear: this table was updated for all 115 counties. VMT by county for the State of Missouri was provided by MoDOT. Area-specific VMT by county for the St. Louis City region was provided by the East/West Gateway Council of Governments. The VMT was distributed to the Vehicle Source Type using a Statewide VMT-Vehicle distribution provided by MoDOT.

- roadtypedistribution: this table was updated for all 115 counties. VMT distribution by road type for the State of Missouri was provided by MoDOT. Seven MOVES road type distribution tables were created, one for each of the seven MoDOT county districts.

  District CD: Boone, Callaway, Camden, Cole, Cooper, Crawford, Dent, Gasconade, Howard, Laclede, Maries, Miller, Moniteau, Morgan, Osage, Phelps, Pulaski, Washington

  District KC: Cass, Clay, Jackson, Johnson, Lafayette, Pettis, Platte, Ray, Saline

  District NE: Adair, Audrain, Clark, Knox, Lewis, Lincoln, Macon, Marion, Monroe, Montgomery, Pike, Ralls, Randolph, Schuyler, Scotland, Shelby, Warren

  District NW: Andrew, Atchison, Buchanan, Caldwell, Carroll, Chariton, Clinton, Daviess, DeKalb, Gentry, Grundy, Harrison, Holt, Linn, Livingston, Mercer, Nodaway, Putnam, Sullivan, Worth

  District SE: Bollinger, Butler, Cape Girardeau, Carter, Douglas, Dunklin, Howell, Iron, Madison, Mississippi, New Madrid, Oregon, Ozark, Pemiscot, Perry, Reynolds, Ripley, Scott, Shannon, St. Francois, Ste. Genevieve, Stoddard, Texas, Wayne, Wright

  District SL: Franklin, Jefferson, St. Charles, St. Louis, St. Louis City

  District SW: Barry, Barton, Bates, Benton, Cedar, Christian, Dade, Dallas, Greene, Henry, Hickory, Jasper, Lawrence, McDonald, Newton, Polk, St. Clair, Stone, Taney, Vernon, Webster

- sourcetypeagedistribution: this table was updated for all 115 counties. A list of Vehicle Identification Numbers (VINs), by county, was provided by the Missouri Department of Revenue. The VINs were decoded into model year and MOBILE6 vehicle classes by ESP Data Solutions, Inc, a private contractor. Specific age distributions were created for all current and formerly proposed non-attainment areas, as well as four distributions created for the remaining counties of the state. These age distributions were converted to the MOVES format using the EPA provided Mobile6 to MOVES conversion excel workbook.

Northeast Counties in Attainment: Adair, Audrain, Boone, Callaway, Carroll, Chariton, Clark, Cole, Cooper, Grundy, Howard, Knox, Lewis, Linn, Livingston, Macon, Marion, Mercer, Moniteau, Monroe, Montgomery, Osage, Pike, Putnam, Ralls, Randolph, Saline, Schuyler, Scotland, Shelby, Sullivan, Warren

Northwest Counties in Attainment: Andrew, Atchison, Bates, Benton, Buchanan, Caldwell, Daviess, DeKalb, Gentry, Harrison, Henry, Holt, Johnson, Lafayette, Nodaway, Pettis, Ray, Worth

Southwest Counties in Attainment: Barry, Barton, Camden, Cedar, Dade, Dallas, Douglas, Hickory, Jasper, Laclede, Lawrence, McDonald, Miller, Morgan, Newton, Ozark, Polk, St. Clair, Vernon, Webster, Wright

Southeast Counties in Attainment: Bollinger, Butler, Cape Girardeau, Carter, Crawford, Dent, Dunklin, Gasconade, Howell, Iron, Madison, Maries, Mississippi, New Madrid, Oregon, Pemiscot, Phelps, Pulaski, Reynolds, Ripley, St. Francois, Scott, Shannon, Stoddard, Texas, Washington, Wayne

Kansas City formerly proposed Non-Attainment area: Cass, Clay, Clinton, Jackson, Platte

Greene County formerly proposed Non-Attainment area: Christian, Greene, Stone, Taney

St Louis current and formerly proposed Non-Attainment area: Franklin, Jefferson, Lincoln, St Charles, St Louis, St Louis City

Perry and Ste. Genevieve formerly proposed Non-Attainment area: Perry, Ste. Genevieve

- sourcetypeyear: this table was updated for all 115 counties. A list of Vehicle Identification Numbers (VINs), by county, was provided by the Missouri Department of Revenue. The VINs were decoded into model year and MOBILE6 vehicle classes by ESP Data Solutions, Inc, a private contractor. Mobile6 vehicle population counts were created for each county. These county vehicle populations were converted to the MOVES format using the EPA provided Mobile6 to MOVES conversion excel workbook.

- fuelsupply: this table was updated for the 110 counties not in the St Louis NonAttainment Area. In 2008, Missouri's ethanol mandate took effect and required a 10% ethanol blend in all gasoline sold except premium gasoline. The 'fuelsupply' table in the 2011 County Databases provided by EPA estimate gasoline without ethanol comprising 27.4% of gasoline sales in Missouri counties outside of the St Louis NonAttainment Area. According to data on the US Energy Information Administration website (http://www.eia.gov/dnav/pet/PET_CONS_REFMG_D_SMO_VTR_MGALPD_A.htm), premium gasoline sales comprised 2.65% of the total gasoline sales in Missouri in 2009, the most current year of available data. This data seems more accurate than the 27.4% market share currently listed in the 2011 County Databases for Missouri. Using the US EIA data to update the 'fuelsupply' tables, the market share for gasohol (E10) would be 97.35% and the market share for non-ethanol-blend gasoline would be 2.65%.

The ‘fuelsupply’ tables for the five counties in the St Louis NonAttainment Area were already populated with the reformulated gasoline that is required in those counties.

- imcoverage: this table was updated for the five counties in the St Louis Ozone NonAttainment Area. These counties are Franklin County (29071), Jefferson County (29099), St Charles County (29183), St Louis County (29187), and St Louis City (29510). IM data was provided by the Air Program’s IM Program. The Air Program used EPA technical guidance on appropriate input assumptions and sources of data for the use of MOVES 2010 in State Implementation Plan (http://www.epa.gov/otaq/models/moves/420b10023.pdf). Section 3.10 of this guidance document explains the appropriate assumptions and methods to be used when developing the I/M input table for MOVES 2010. This guidance was followed in the development of the I/M input Tables. The following outlines the approach used to develop each parameter of these I/M input tables in MOVES.

Pollutant Process ID

To begin development of the I/M input table, the default data for the I/M input table for St. Louis County was exported from the MOVES county database manager. The default data included four different I/M test types. However, the actual St. Louis area only had two different test types (On-board diagnostics) OBD tests for the exhaust and evaporative systems. In the default I/M input table, these were the only two types of tests that were “turned on” along with the appropriate pollutant process IDs that would be impacted by each test. Therefore, the pollutant process IDs that were included in the default table for the two OBD tests were the same pollutant process IDs used in the I/M input table for the St. Louis nonattainment area. The other two tests included in the default data along with their associated pollutant process IDs were still included in the I/M input table, but they were “turned off”.

Source Type ID

The St. Louis I/M program includes passenger cars and also trucks with a gross vehicle weight rating of 8,500 lbs. or less. Therefore, the three source type IDs included in the I/M input table for the St. Louis nonattainment area are passenger cars, passenger trucks, and light commercial trucks (IDs = 21, 31, and 32).

Inspection Frequency

The St. Louis I/M program requires that emission be tested every two years, so the inspection frequency ID that represents biennial tests (ID = 2) was used in the I/M input table for the OBD tests applicable to the St. Louis nonattainment area.

Test Standards

The St. Louis I/M program is a centralized program with OBD tests for exhaust and evaporative systems on the vehicles. Therefore, the test standard IDs for exhaust OBD check and the evaporative system OBD check (IDs = 43 and 51) were used in the I/M input table for the St. Louis nonattainment area.

I/M Program ID

This is an arbitrary number developed by the MOVES user to define a unique test given for vehicles within a range of model years. Therefore, I/M program IDs were arbitrarily assigned to the various unique tests within the St. Louis I/M program.

Beginning and Ending Model Years

The St. Louis I/M program applies to gasoline vehicles with a model year of 1996 or later and it also applies to diesel vehicles with a model year of 1997 or later. Since the emissions inspection is required biennially, the ending model year would always be two years less than the emissions inventory year that is being developed. Therefore, for the tests for gasoline vehicles, the beginning model year is 1996 and the ending model year is two years earlier than the year for which MOVES is being run, and the for diesel vehicles the beginning model year is 1997 and the ending model year is two years earlier than the year for which MOVES is being run.

Compliance Factor

According to page 39 of the MOVES guidance document the compliance factor is calculated with the following equation:

Compliance Factor = percent compliance rate x (100 – percent waiver rate) x regulatory class coverage adjustment.

Therefore, in order to calculate the compliance factor for each source type included in the I/M program, the compliance rate, waiver rate, and regulatory class coverage adjustment needed to be determined. These three values were determined by the processes described below and then the compliance factors for each source type were calculated with the equation written above.

Compliance Rate

The compliance rate was calculated with the following equation:

Compliance Rate = Number of vehicles that were tested over a two year period (2010 – 2011) / Population of vehicles that is theoretically subject to I/M during the same period.

In order to determine the compliance rate, as it compares to the source type population by model year, the population of vehicles that is theoretically subject to I/M first needed to be determined.

In May 2012, the Missouri Department of Revenue (DOR) Vehicle Registration database was queried and a VIN decoder was used to separate the vehicle counts into Mobile 6.2 vehicle classes by model year. In the St. Louis nonattainment area, the Mobile 6.2 vehicle classes that are subject to I/M include 1996 and newer light duty gasoline vehicles, light duty gasoline trucks Class 1, light duty gasoline trucks Class 2, light duty gasoline trucks Class 3, light duty gasoline trucks Class 4, as well as 1997 and newer light duty diesel vehicles, light duty diesel trucks Class 1, light duty diesel trucks Class 2, light duty diesel trucks Class 3, and light duty diesel trucks Class 4. The table below shows the total combined population of

these 10 vehicle classes within the appropriate model years by county in the St. Louis nonattainment area according the May 2012 DOR data.

Vehicles Theoretically Subject to the I/M Program in the St. Louis Nonattainment Area

County	Light Duty Gas (1996 and newer)	Light Duty Diesel (1997 and newer)
Franklin	74,904	398
Jefferson	158,322	553
St Charles	270,453	854
St Louis City	143,503	517
St Louis County	792,960	2,352
Total	1,440,142	4,674
Total Count	**1,444,816**	

The Air Program also queried the I/M report generator to determine the total number of vehicles, which had their emissions tested at least once from January 1, 2010 through December 31, 2011. The query also included the total number of vehicles that received waivers during the same time period. The table below, was generated with data from this query.

Initially Tested Vehicles that Received a Waiver in the St. Louis I/M Program from January 1, 2010 through December 31, 2011

Model Year	Passenger Car			Truck			Total Initially Tested		
	Test Count	Waivers	% Waivers	Test Count	Waivers	% Waivers	Test Count	Waivers	% Waivers
1996	32,015	295	0.92 %	10,024	75	0.75 %	42,039	370	0.88 %
1997	40,698	156	0.38 %	12,314	34	0.28 %	53,012	190	0.36 %
1998	52,841	236	0.45 %	15,709	72	0.46 %	68,550	308	0.45 %
1999	63,520	139	0.22 %	17,052	28	0.16 %	80,572	167	0.21 %
2000	78,614	318	0.40 %	19,769	67	0.34 %	98,383	385	0.39 %
2001	80,007	270	0.34 %	18,769	39	0.21 %	98,776	309	0.31 %
2002	97,599	314	0.32 %	21,911	62	0.28 %	119,510	376	0.31 %
2003	90,007	134	0.15 %	20,853	18	0.09 %	110,860	152	0.14 %
2004	99,537	161	0.16 %	22,613	34	0.15 %	122,150	195	0.16 %
2005	103,390	66	0.06 %	19,223	11	0.06 %	122,613	77	0.06 %
2006	101,753	116	0.11 %	18,218	18	0.10 %	119,971	134	0.11 %
2007	113,181	30	0.03 %	19,128	4	0.02 %	132,309	34	0.03 %
2008	109,592	64	0.06 %	16,640	14	0.08 %	126,232	78	0.06 %
2009	82,184	29	0.04 %	8,984	0	0.00 %	91,168	29	0.03 %
2010	27,720	19	0.07 %	2,918	3	0.10 %	30,638	22	0.07 %
2011	7,060	0	0.00 %	467	0	0.00 %	7,527	0	0.00 %
2012	124	0	0.00 %	2	0	0.00 %	126	0	0.00 %
Total	**1,179,842**	**2,347**	**0.20 %**	**244,594**	**479**	**0.20 %**	**1,424,436**	**2,826**	**0.20 %**

Using the data from the two tables above, the compliance rate is calculated for the St. Louis I/M Program with the following equation:

Compliance Rate: (1,424,436 / 1,444,816) x 100% = 98.59%

Waiver Rate

The waiver rate is the percentage of vehicles that fail an initial I/M test and do not pass a retest, but do receive a certificate of compliance. The waiver rate was determined by dividing the number of vehicles that received waivers from January 1, 2010 through December 31, 2011 by the total number of vehicles that were tested at least once during the same time period. Therefore, the waiver rate was calculated for the St. Louis I/M Program with the following equation:

Waiver Rate: (2,826 / 1,444,816) X 100% = 0.20%

Regulatory Class Coverage Adjustment

The regulatory class coverage adjustment is an adjustment that accounts for the fraction of vehicles within a source type that are covered by the I/M program. Since the I/M program in St. Louis exempts vehicles with a gross vehicle weight rating above 8,500 lbs., the compliance factor needs to reflect the percentage of vehicles in the source types subject to I/M that are exempt because of their GVWR. Table A.3 in the Appendix of the MOVES Technical Guidance Document was used to develop adjustments to the compliance factor to account for this discrepancy. The adjustments are percentages of vehicle miles traveled by the various regulatory weight classes within a source type. The corresponding adjustment factors used for the three source categories are as follow:

Passenger cars: 100%

Passenger Trucks: 94%

Light Commercial Trucks: 88%

Calculating the Compliance Factor

Based on the calculations listed above the compliance factor for each source category impacted by the I/M program in St. Louis is listed below.

Passenger cars: 98.59% x (100% - 0.20%) x 100% = **98.39%**

Passenger Trucks: 98.59% x (100% - 0.20%) x 94% = **92.49%**

Light Commercial Trucks: 98.59% x (100% - 0.20%) x 88% = **86.59%**

9.2 Nonroad Inventory

9.2.1 Nonroad Model

EPA's NONROAD model (http://www.epa.gov/otaq/nonrdmdl.htm) estimates emissions from engines not used on roads. Examples include lawn and garden equipment, construction equipment, recreational equipment engines, and portable industrial, commercial, and agricultural engines. Commercial marine, aircraft, and locomotive engine emissions are not included in the NONROAD model, and their emission estimates are covered in sections 9.2.2 through 9.2.4.

The National Mobile Inventory Model (NMIM) (http://www.epa.gov/otaq/nmim.htm) is EPA's consolidated mobile emissions estimation system that allows EPA to produce nonroad mobile emissions in a consistent and automated way for the entire country. EPA encouraged state and local agencies to submit NMIM inputs to the EIS for the 2011 NEI for inclusion in the National County Database (NCD). The NCD contains all the county-specific information needed to run NONROAD. Although NMIM was also designed to estimate onroad emissions, it is no longer used for that purpose, and the MOVES model is used for onroad emissions (see section 9.1). Eventually, MOVES will be revised to also estimate nonroad emissions and NMIM will be retired.

NMIM estimates emissions for engines with a variety of fuel types, from diesel and gasoline to LPG and CNG. The model estimates monthly emissions for total hydrocarbons (THC), nitrogen oxides, carbon monoxide, particulate matter, and sulfur dioxide, as well as calculates monthly fuel consumption. NMIM uses ratios from some of these emissions to calculate emissions for an additional 33 HAPs and 17 dioxin/furan congeners. All of the input and activity data required to run NMIM are contained within the NCD, which is distributed with the model. State and local agencies are able to update the data within the NCD to create emission estimates that accurately reflect local conditions and equipment usage.

Missouri did not submit updates to the NCD as no state-specific updates to equipment population, distribution, or temporal usage is available. The default NCD was used by EPA to estimate Missouri's emissions using the NONROAD model, and Missouri accepted these emission values. To quality assure the emission totals, Missouri also ran the NONROAD model using the default NCD, and the emission totals matched EPA's results.

9.2.2 Commercial Marine

The Missouri DNR accepted EPA's estimates of emissions for this source category. No documentation was provided by EPA.

9.2.3 Aircraft

The Missouri DNR accepted EPA's estimates of emissions for this source category. Documentation is available in Appendix B-5 – 2011 Aircraft LTO Processing for the National Emission Inventory.

9.2.4 Locomotive

The Missouri DNR accepted EPA's estimates of emissions for this source category. Documentation is available in Appendix B-6- Development of 2011 Railroad Component for National Emissions Inventory.

10.0 Biogenic Inventory

Per the AERR, EPA creates the biogenic inventory with no updates or improvement from state or local agencies. The documentation below is taken from EPA's Draft NEI documentation

Biogenic emission sources are emissions that come from natural sources. They need to be accounted for in photochemical grid models, as most types are widespread and ubiquitous contributors to background air chemistry. In the NEI, only the emissions from vegetation and soils are included, but other relevant sources include volcanic emissions, lightning, and sea salt.

Biogenic emissions from vegetation and soils are computed using a model which utilizes spatial information on vegetation and land use and environmental conditions of temperature and solar radiation. The model inputs are typically horizontally allocated (gridded) data, and the outputs are gridded biogenic emissions which can then be speciated and utilized as input to photochemical grid models.

Sector Description

In the 2011 NEI, biogenic emissions are included in the nonpoint data category, in the EIS sector "Biogenics – Vegetation and Soil." The table below lists the two SCCs used in the 2011 NEI that comprise this sector. These 2 SCCs have distinct pollutants: SCC 2701220000 has only NO_X emissions, and SCC 2701200000 has emissions for CO, VOC and 3 VOC HAPs: formaldehyde, acetaldehyde and methanol.

Source Classification Code	EI Sector	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Tier 1 Description	Tier 2 Description	Tier 3 Description
2701200000	Biogenics - Vegetation and Soil	Natural Sources	Biogenic	Vegetation	Total	Natural Resources	Biogenic	Vegetation
2701220000	Biogenics - Vegetation and Soil	Natural Sources	Biogenic	Vegetation/ Agriculture	Total	Natural Resources	Biogenic	Vegetation

The biogenic emissions for the 2011 NEI were computed based on 2011 meteorology data from the Weather Research and Forecasting (WRF) Model using the Biogenic Emission Inventory System, version 3.14 (BEIS3.14) model within SMOKE. The BEIS3.14 model creates gridded, hourly, model-species emissions from vegetation and soils. The 12-kilometer gridded hourly data are summed to monthly and annual level, and are mapped from 12-kilometer grid cells to counties using a standard mapping file. BEIS produces biogenic emissions for a modeling domain which includes the contiguous 48 states in the U.S., parts of Mexico, and Canada. The NEI uses the biogenic emissions from counties from the contiguous 48.

The model-species are those associated with the carbon bond 2005 chemical mechanism (CB05). The NEI pollutants produced are: CO, VOC, NO_X, methanol, formaldehyde and acetaldehyde. VOC is the sum of all other biogenic species except CO, NO, SESQ. Mapping of BEIS pollutants to NEI pollutants is as follows:

- NO maps to NO_X
- FORM maps to formaldehyde;
- ALD2 maps to acetaldehyde;
- MEOH maps to methanol;
- VOC is the sum of all other biogenic species except CO, NO, SESQ.

The BEIS3.14 model is described further in:
http://www.cmascenter.org/conference/2011/slides/pouliot_tale_two_cmas08.ppt

The inputs to BEIS include:

- Temperature data at 2 meters which were obtained from the WRF input files to the air quality model,

- Land-use data from the Biogenic Emissions Land use Database, version 3 (BELD3). BELD3 data provides data on the 230 vegetation classes at 1-km resolution over most of North America. These data are available at http://www.epa.gov/ttnchie1/emch/biogenic/.

Sources of data overview and selection hierarchy

The only source of data for this sector is the EPA-estimated emissions from BEIS3.14. States are neither required nor encouraged to report emissions, and no state has done this. The name of the EPA dataset in EIS is: 2011EPA_biogenics.

Spatial coverage and data sources for the sector

The spatial coverage of the biogenics emissions is governed by the "2011 platform" modeling domain which covers all counties in the lower 48 states. More information on this modeling platform is available at http://www.epa.gov/ttn/chief/emch/index.html#2011.

Biogenic emissions are a very large fraction of the total NEI VOC, methanol, formaldehyde and acetaldehyde emissions but a very small fraction of the CO and NO_x.

More detailed summaries of the BEIS model species at county level and monthly are available as a supporting summary on the 2011 web page
(ftp://ftp.epa.gov/EmisInventory/2011/2011_biogenic_reports.zip).

11.0 Event Inventory

The 2011 inventory included prescribed fires and wild fires, but no other events. Missouri DNR accepted EPA's estimates of emissions for these types of events. Appendix B-7 is the technical memorandum from Sonoma Technology, Inc. (STI) explaining STI's role in developing wild fire emissions for EPA.

12.0 EIS Data Submission

A total of 505 facilities were required to be reported as point sources to the 2011 NEI according to the AERR. Facility information along with relevant emissions data was uploaded to the Emission Inventory System (EIS) Gateway. Several steps were taken to prepare MoEIS data for submission to the NEI. Key steps included:

- All active emission units for previously identified facilities were retrieved from MoEIS and matched to corresponding emission units in EPA's EIS. Attributes such as operating status and descriptions were changed in the EPA database as needed. Also, new units were added to the NEI.
- All facilities with Part 70 or Intermediate Operating Permits during the 2011 emission year were identified. Also, facilities that had a Part 70 or Intermediate Operating Permit for only a portion of the year were found and added to the submission list.
- A table of Emission Release Points for the previously identified Emission Units was compiled, including all relevant stack data. Missing stack data was obtained by contacting facility representatives or reviewing issued permits.
- All active Emission Processes for the previously identified facilities were retrieved from MoEIS and matched to corresponding emission units in EPA's database. Attributes such as the SCC code were changed as needed. Also, new processes were added to the EIS.
- Control device information was searched for missing data such as pollutant codes and percentage controlled. Data was obtained and added as needed. Additionally, a query was written to verify that all active control devices were connected to an emission unit, while others verify that controlled units are marked as such and that controlled emission factors are used when appropriate.
- The data was queried to ensure that emission factors are marked controlled or uncontrolled as appropriate.
- Both MoEIS and EPA's system allow a division of emissions between different release paths. However, MoEIS requires the sum total of emissions to equal 100% at the unit level, while the federal system requires a sum of 100% per emission process. An Access query is used to determine which units have multiple processes so that corrections can be made before submission.
- An Access query was developed to ensure that point source facilities in the 5-county St. Louis ozone nonattainment area are including typical ozone season day emissions for VOC, NO_x, and CO on the Ozone Season worksheet as required.

Data was transferred in steps to lower the total number of errors during each step of the submittal process. Basic facility information was uploaded first, followed by:

- Emission Units – All active emission units in MoEIS for the 505 facilities were uploaded. Operating status was changed for formerly active units.
- Emission Release Points- All active emission release points were uploaded. Operating status was changed for formerly active units.

- Emission Processes- All active emission processes uploaded and any that were no longer reportable were given a "last reporting year" in the EIS gateway.
- Control Approach- All active controls along with control percentage and pollutants controlled were uploaded.
- Emissions- Criteria and HAP annual pollutant emissions were uploaded to the EIS gateway.
- Ozone emissions for facilities in the nonattainment area were uploaded.

After each submittal, accuracy was verified by downloading the inventory from the gateway and comparing it to the data in MoEIS.

Each nonpoint data category was submitted individually to the EIS where Missouri was providing a state-specific update to an EPA-provided number, or where Missouri estimated emissions independently of EPA. Where Missouri accepted the EPA estimate, a support request was sent via the EIS listing the SCCs for which Missouri accepted EPA's estimation.

Missouri submitted the onroad mobile data inputs for the MOVES model, as requested in the AERR. Using those model inputs, EPA is able to run the model and create emission estimates identical to Missouri's model runs.

Appendix B-1

EIQ Forms

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 1.0 GENERAL PLANT INFORMATION

☐ **Request Confidentiality - see instructions to initiate the confidentiality request.**

FACILITY NAME			FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA
FACILITY STREET ADDRESS			COUNTY NAME		
CITY	ZIP CODE +4	PHONE NUMBER WITH AREA CODE		EXT.	FAX NUMBER WITH AREA CODE
FACILITY MAILING ADDRESS		CITY		STATE	ZIP CODE +4
FACILITY CONTACT NAME	FACILITY CONTACT TITLE	FACILITY CONTACT E-MAIL		WHERE TO SEND EIQ IN FUTURE (CHECK ONE) ☐ Facility Mailing Address ☐ Parent Company Mailing Address	
PRODUCT/PRINCIPAL ACTIVITY		SIC	NAICS	NUMBER OF EMPLOYEES	

	LATITUDE	LONGITUDE	UTM COORDINATES				
DEGREES			ZONE	EASTING (M)	NORTHING (M)	ACC (M)	HORIZONTAL DATUM (CHECK ONE) ☐ NAD27 ☐ WGS84 ☐ NAD83
MINUTES							
SECONDS							

PARENT COMPANY NAME		PHONE NUMBER WITH AREA CODE	EXT.	FAX NUMBER WITH AREA CODE
MAILING ADDRESS		CITY	STATE	ZIP CODE +4
CONTACT PERSON NAME	CONTACT PERSON TITLE	CONTACT PERSON E-MAIL		COUNTRY

TOTAL PLANT EMISSIONS FROM FORM 3.0 (TONS PER YEAR)

PM_{10}	SO_X	NO_X	VOC	CO	LEAD	HAPs	$PM_{2.5}$	NH_3

The undersigned hereby certifies that they have personally examined and are familiar with the information and statements contained herein and further certifies that they believe this information and statements to be true, accurate and complete. The undersigned certifies that knowingly making a false statement or misrepresenting the facts presented in this document is a violation of state law.

PRINT NAME OF PERSON COMPLETING FORM	TITLE	PAYMENT AMOUNT
SIGNATURE	DATE	CHECK/AUTH. NO.
PRINT NAME OF AUTHORIZED COMPANY REPRESENTATIVE	TITLE	PAYMENT DATE
SIGNATURE	DATE	

CONTACT INFORMATION	OFFICE USE ONLY	
Missouri Department of Natural Resources Air Pollution Control Program 1659 E. Elm St. Jefferson City, MO 65101 573-751-4817 www.dnr.mo.gov/env/apcp/moeis/emissionsreporting.htm eiq@dnr.mo.gov	LOGGED IN BY	DATE

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 1.1 PROCESS FLOW DIAGRAM

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

Use this page or a separate sheet to provide a Process Flow Diagram per the instructions for Form 1.1 in the Instruction Packet. Do not forget to include all processes used in your facility. Make sure to label each process and piece of equipment and provide an identification number for all emission units (including fugitive emissions) and air pollution control equipment. Make sure to use the same identification number throughout the entire EIQ.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 1.2 SUMMARY OF EMISSION UNITS AND RELATED PROCESSES

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

INSTRUCTIONS

If all emissions are under the reporting threshold, mark below as "Insignificant", and do not report on Forms 2.0 and 3.0.
If one pollutant exceeds the reporting threshold, mark below as "Active" and report all pollutants on Forms 2.0 and 3.0.

REPORTING THRESHOLD

Pollutant	PM_{10}	SO_x	NO_x	VOC	CO	CATEGORY 1 HAPs	CATEGORY 2 HAPs	$PM_{2.5}$	NH_3
Threshold (lbs)	876	2,000	2,000	876	2,000	20	200	876	876
Threshold (tons)	0.438	1.0	1.0	0.438	1.0	0.01	0.1	0.438	0.438

EMISSION UNIT NO. / SCC	EMISSION UNIT DESCRIPTION (USE SAME DESCRIPTION ON FORM 2.0)	OPERATING STATUS (CHOOSE ONE)				
		Active	Inactive	Dismantled	Under Construction	Insignificant

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0 EMISSION UNIT INFORMATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. EMISSION UNIT IDENTIFICATION

EMISSION UNIT NO.	EMISSION UNIT DESCRIPTION

2. EMISSION PROCESS DETAIL

SEG. NO.	SOURCE CLASSIFICATION CODE (SCC)	SCC DESCRIPTION

DO THE EMISSIONS FROM THIS UNIT FLOW THROUGH A STACK OR VENT? ☐ Yes ☐ No IF YES, COMPLETE *FORM 2.0S STACK/VENT INFORMATION*

ARE THE EMISSIONS FROM THIS UNIT FUGITIVE? ☐ Yes ☐ No IF FUGITIVE, WHAT PERCENTAGE?

3. OPERATING RATE/SCHEDULE

ANNUAL THROUGHPUT		UNITS		DEC-FEB (%)
				MAR-MAY (%)
HOURS / DAY	DAYS / WEEK	WEEKS / YR.	TOTAL HOURS / YR.	JUN-AUG (%)
				SEPT-NOV (%)

4. ANNUAL FUEL CHARACTERISTICS

For coal or fuel oil, list details below

Heat Content (BTU/Fuel Unit)
ASH % (INCLUDE IN EF)
SULFUR % (INCLUDE IN EF)

5. EMISSION CALCULATIONS

AIR POLLUTANT	1. SOURCE OF EMISSION FACTOR	2. EMISSION FACTOR	3. EMISSION FACTOR (EF) CONTROL STATUS	4. OVERALL CONTROL EFFICIENCY (% FORMAT)	5. ACTUAL EMISSIONS (TONS/YR)
Instructions:	Choose from the Source of Emission Factor List at lower right	Lbs./unit of throughput	If EF includes control mark "C", otherwise "U"	Combination of all capture and destruction efficiencies	If controlled, include *Form 2.0C Control Device Listing*
PM_{10}					
SO_X					
NO_X					
VOC					
CO					
LEAD					
HAPs					
$PM_{2.5}$					
NH_3					

Annual Throughput
× Emission Factor
× (1-Overall Control Eff/100)
÷ 2,000
= Actual Emissions (tons)

List Other Worksheets or AP-42/Other Reference

SOURCE OF EMISSION FACTOR LIST

1. CEM	Include documentation
2. Stack Test	Include documentation
3. Mass Balance	Include documentation
4. AP-42	Include reference
4F. FIRE or webFIRE	
5. Other	Include documentation
EC. Engr Calc	Include documentation
LS. Landfill Spdsht	Include documentation
TK. TANKS Program	Supply TANKS output
2.3. VOC Mass Bal	Complete Form 2.3
2.4. Liquid Loading	Complete Form 2.4
2.7. Haul Road	Complete Form 2.7
2.8. Storage Pile	Complete Form 2.8
2.T. HAP Worksheet	Complete Form 2.T
2.9. Stack Test/CEM	Complete Form 2.9
2.0L. Landfill	Complete Form 2.0L

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0 PART 70 OPERATING PERMIT EMISSION UNIT INFORMATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. EMISSION UNIT IDENTIFICATION

EMISSION UNIT NO.	EMISSION UNIT DESCRIPTION

2. EMISSION PROCESS DETAIL

SEG. NO.	SOURCE CLASSIFICATION CODE (SCC)	SCC DESCRIPTION

DO THE EMISSIONS FROM THIS UNIT FLOW THROUGH A STACK OR VENT? ☐ Yes ☐ No IF YES, COMPLETE *FORM 2.0S STACK/VENT INFORMATION*

ARE THE EMISSIONS FROM THIS UNIT FUGITIVE? ☐ Yes ☐ No IF FUGITIVE, WHAT PERCENTAGE?

3. OPERATING RATE/SCHEDULE

ANNUAL THROUGHPUT	UNITS	DEC-FEB (%)
		MAR-MAY (%)

HOURS / DAY	DAYS / WEEK	WEEKS / YR	TOTAL HOURS / YR	JUN-AUG (%)
				SEPT-NOV (%)

4. ANNUAL FUEL CHARACTERISTICS

For coal or fuel oil, list details below

Heat Content (BTU/Fuel Unit)

ASH % (INCLUDE IN EF)

SULFUR % (INCLUDE IN EF)

5. EMISSION CALCULATIONS

AIR POLLUTANT	1. SOURCE OF EMISSION FACTOR	2. EMISSION FACTOR	3. EMISSION FACTOR (EF) CONTROL STATUS	4. OVERALL CONTROL EFFICIENCY (% FORMAT)	5. ACTUAL EMISSIONS (TONS/YR)
Instructions:	Choose from the Source of Emission Factor List at lower right	Lbs/unit of throughput	If EF includes control mark "C", otherwise "U"	Combination of all capture and destruction efficiencies	If controlled, include *Form 2.0C Control Device Listing*
PM_{10} FIL *					
SO_X					
NO_X					
VOC					
CO					
LEAD					
HAPs					
$PM_{2.5}$ FIL *					
NH_3					
PM CON *					

Annual Throughput
× **Emission Factor**
× **(1-Overall Control Eff/100)**
÷ **2,000**
= **Actual Emissions (tons)**

List Other Worksheets or AP-42/Other Reference	

SOURCE OF EMISSION FACTOR LIST

1. CEM	Include documentation
2. Stack Test	Include documentation
3. Mass Balance	Include documentation
4. AP-42	Include reference
4F. FIRE or webFIRE	
5. Other	Include documentation
EC. Engr Calc	Include documentation
LS. Landfill Spdsht	Include documentation
TK. TANKS Program	Supply TANKS output
2.3. VOC Mass Bal	Complete Form 2.3
2.4. Liquid Loading	Complete Form 2.4
2.7. Haul Road	Complete Form 2.7
2.8. Storage Pile	Complete Form 2.8
2.T. HAP Worksheet	Complete Form 2.T
2.9. Stack Test/CEM	Complete Form 2.9
2.0L. Landfill	Complete Form 2.0L

* If PM CON is reported, PM10 and PM25 entries above are required and should represent only the filterable PM10 and filterable PM25.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0C CONTROL DEVICE INFORMATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DEVICE NO.	DEVICE CODE

CONTROL DEVICE DESCRIPTION

OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

ARE THE EMISSIONS CONTROLLED THROUGH THE STACK/VENT ONLY? ☐ Yes ☐ No

LIST ALL STACK/VENT NUMBERS SHARING THIS CONTROL DEVICE (LISTED ON *FORM 2.0S STACK/VENT INFORMATION*)

AIR POLLUTANT	PM_{10}	SO_X	NO_X	VOC	CO	LEAD	HAP(s)	$PM_{2.5}$	NH_3
CAPTURE EFFICIENCY (%)									
CONTROL DEVICE EFFICIENCY (%)									
SOURCE OF EFFICIENCY (CODES)									

CAS NUMBER(S) FOR CONTROLLED HAPS

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DEVICE NO.	DEVICE CODE

CONTROL DEVICE DESCRIPTION

OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

ARE THE EMISSIONS CONTROLLED THROUGH THE STACK/VENT ONLY? ☐ Yes ☐ No

LIST ALL STACK/VENT NUMBERS SHARING THIS CONTROL DEVICE (LISTED ON *FORM 2.0S STACK/VENT INFORMATION*)

AIR POLLUTANT	PM_{10}	SO_X	NO_X	VOC	CO	LEAD	HAP(s)	$PM_{2.5}$	NH_3
CAPTURE EFFICIENCY (%)									
CONTROL DEVICE EFFICIENCY (%)									
SOURCE OF EFFICIENCY (CODES)									

CAS NUMBER(S) FOR CONTROLLED HAPS

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DEVICE NO.	DEVICE CODE

CONTROL DEVICE DESCRIPTION

OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

ARE THE EMISSIONS CONTROLLED THROUGH THE STACK/VENT ONLY? ☐ Yes ☐ No

LIST ALL STACK/VENT NUMBERS SHARING THIS CONTROL DEVICE (LISTED ON *FORM 2.0S STACK/VENT INFORMATION*)

AIR POLLUTANT	PM_{10}	SO_X	NO_X	VOC	CO	LEAD	HAP(s)	$PM_{2.5}$	NH_3
CAPTURE EFFICIENCY (%)									
CONTROL DEVICE EFFICIENCY (%)									
SOURCE OF EFFICIENCY (CODES)									

CAS NUMBER(S) FOR CONTROLLED HAPS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0C PART 70 OPERATING PERMIT CONTROL DEVICE INFORMATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DEVICE NO.	DEVICE CODE

CONTROL DEVICE DESCRIPTION

OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

ARE THE EMISSIONS CONTROLLED THROUGH THE STACK/VENT ONLY? ☐ Yes ☐ No

LIST ALL STACK/VENT NUMBERS SHARING THIS CONTROL DEVICE (LISTED ON *FORM 2.0S STACK/VENT INFORMATION*)

AIR POLLUTANT	PM_{10} FIL	SO_X	NO_X	VOC	CO	LEAD	HAP(s)	$PM_{2.5}$ FIL	NH_3	PM CON
CAPTURE EFFICIENCY (%)										
CONTROL DEVICE EFFICIENCY (%)										
SOURCE OF EFFICIENCY (CODES)										

CAS NUMBER(S) FOR CONTROLLED HAPS

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DEVICE NO.	DEVICE CODE

CONTROL DEVICE DESCRIPTION

OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

ARE THE EMISSIONS CONTROLLED THROUGH THE STACK/VENT ONLY? ☐ Yes ☐ No

LIST ALL STACK/VENT NUMBERS SHARING THIS CONTROL DEVICE (LISTED ON *FORM 2.0S STACK/VENT INFORMATION*)

AIR POLLUTANT	PM_{10} FIL	SO_X	NO_X	VOC	CO	LEAD	HAP(s)	$PM_{2.5}$ FIL	NH_3	PM CON
CAPTURE EFFICIENCY (%)										
CONTROL DEVICE EFFICIENCY (%)										
SOURCE OF EFFICIENCY (CODES)										

CAS NUMBER(S) FOR CONTROLLED HAPS

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DEVICE NO.	DEVICE CODE

CONTROL DEVICE DESCRIPTION

OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

ARE THE EMISSIONS CONTROLLED THROUGH THE STACK/VENT ONLY? ☐ Yes ☐ No

LIST ALL STACK/VENT NUMBERS SHARING THIS CONTROL DEVICE (LISTED ON *FORM 2.0S STACK/VENT INFORMATION*)

AIR POLLUTANT	PM_{10} FIL	SO_X	NO_X	VOC	CO	LEAD	HAP(s)	$PM_{2.5}$ FIL	NH_3	PM CON
CAPTURE EFFICIENCY (%)										
CONTROL DEVICE EFFICIENCY (%)										
SOURCE OF EFFICIENCY (CODES)										

CAS NUMBER(S) FOR CONTROLLED HAPS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0K CHARCOAL KILN INFORMATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA
EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)		SEG. NO.

COMPLETE ONE OF THE FOLLOWING SECTIONS FOR EACH CHARCOAL KILN/CONCRETE PAD

KILN ID NO.	YEAR KILN BEGAN OPERATING	TONS PRODUCED THIS YEAR	IF NO PRODUCTION, LAST YEAR OF PRODUCTION		AFTERBURNER OR RECOVERY SYSTEM
MAXIMUM TONS PRODUCED IN ONE BATCH	NUMBER OF HOURS REQUIRED TO PRODUCE ONE BATCH	MAX HOURLY DESIGN RATE	DOLLARS SPENT ON RENOVATION		☐ Yes ☐ No
			LAST YEAR	SINCE 1991	
PRESENT CONDITION					

KILN ID NO.	YEAR KILN BEGAN OPERATING	TONS PRODUCED THIS YEAR	IF NO PRODUCTION, LAST YEAR OF PRODUCTION		AFTERBURNER OR RECOVERY SYSTEM
MAXIMUM TONS PRODUCED IN ONE BATCH	NUMBER OF HOURS REQUIRED TO PRODUCE ONE BATCH	MAX HOURLY DESIGN RATE	DOLLARS SPENT ON RENOVATION		☐ Yes ☐ No
			LAST YEAR	SINCE 1991	
PRESENT CONDITION					

KILN ID NO.	YEAR KILN BEGAN OPERATING	TONS PRODUCED THIS YEAR	IF NO PRODUCTION, LAST YEAR OF PRODUCTION		AFTERBURNER OR RECOVERY SYSTEM
MAXIMUM TONS PRODUCED IN ONE BATCH	NUMBER OF HOURS REQUIRED TO PRODUCE ONE BATCH	MAX HOURLY DESIGN RATE	DOLLARS SPENT ON RENOVATION		☐ Yes ☐ No
			LAST YEAR	SINCE 1991	
PRESENT CONDITION					

KILN ID NO.	YEAR KILN BEGAN OPERATING	TONS PRODUCED THIS YEAR	IF NO PRODUCTION, LAST YEAR OF PRODUCTION		AFTERBURNER OR RECOVERY SYSTEM
MAXIMUM TONS PRODUCED IN ONE BATCH	NUMBER OF HOURS REQUIRED TO PRODUCE ONE BATCH	MAX HOURLY DESIGN RATE	DOLLARS SPENT ON RENOVATION		☐ Yes ☐ No
			LAST YEAR	SINCE 1991	
PRESENT CONDITION					

KILN ID NO.	YEAR KILN BEGAN OPERATING	TONS PRODUCED THIS YEAR	IF NO PRODUCTION, LAST YEAR OF PRODUCTION		AFTERBURNER OR RECOVERY SYSTEM
MAXIMUM TONS PRODUCED IN ONE BATCH	NUMBER OF HOURS REQUIRED TO PRODUCE ONE BATCH	MAX HOURLY DESIGN RATE	DOLLARS SPENT ON RENOVATION		☐ Yes ☐ No
			LAST YEAR	SINCE 1991	
PRESENT CONDITION					

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0L LANDFILL WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.

LANDFILL INFORMATION

TYPE OF LANDFILL (CHECK ONE)

- ☐ New
- ☐ Existing
- ☐ Closed

IF CLOSED, DATE OF LAST WASTE ACCEPTED

TIME SINCE CLOSURE (YRS.) c= CELL(B15)

☐ Used EPA's software (LANDGEM) (attach summary)

TYPE OF CONTROL (CHECK ONE)

- ☐ Flare
- ☐ Control system
- ☐ Enclosed combustor
- ☐ None

TIME SINCE INITIAL REFUSE PLACEMENT (YRS.) t= CELL(B13)

☐ Used DNR spreadsheet created with Microsoft® Excel® (attach copies)

CAPTURE EFFICIENCY CELL(B17)

Default capture efficiency is 75 percent. Documentation must be supplied for other values.

DESTRUCTION EFFICIENCY (%) CELL(B24)	LANDFILL DESIGN CAPACITY (CUBIC METERS)
AVERAGE ANNUAL REFUSE ACCEPTANCE RATE (Mg/YR.) R= CELL(B14)	MASS OF SOLID WASTE IN THE LANDFILL (Mg)
ACRES OF LANDFILL CELL(B16)	GAS SENT OFF-SITE (MMCF) CELL(B18)

CALCULATION OF EMISSIONS

Default values are 100 m^3/Mg for L (Methane generation rate potential) and 0.04/yr for k (Methane generation rate constant).

METHANE GENERATION RATE (QCH4) (m3/YR.) CELL(G11)	METHANE GENERATION RATE (MMCF) CELL(H11)
SO_2 EMISSIONS (LB./YR.) CELL(N35)	HCl EMISSIONS (LB./YR.) CELL(I50)
NMOC (VOC) FUGITIVE EMISSIONS (LB./YR.) CELL(G88)	NMOC (HAP ONLY) FUGITIVE EMISSIONS (LB./YR.) CELL(G51)
NMOC (VOC) COLLECTED, UNCONTROLLED (LB./YR.) CELL(I88)	NMOC (HAP ONLY) COLLECTED, UNCONTROLLED (LB./YR.) CELL(I51)
NMOC (VOC) EMISSIONS FROM CONTROL (LB./YR.) CELL(K88)	NMOC (HAP ONLY) EMISSIONS FROM CONTROL (LB./YR.) CELL(K51)

CALCULATION OF EMISSION FACTORS

Report fugitive emissions and controlled emissions on separate Forms 2.0.

Fugitive emissions use SCC 50100402, throughput units of acres.

VOC FUGITIVE EMISSION FACTOR (LB./ACRE) CELL(L31)	HAP FUGITIVE EMISSION FACTOR (LB./ACRE) CELL(L32)

Waste gas flares use SCC 50100410, throughput unit of MMCF burned.

For SCCs for other controls, contact your regulatory agency.

VOC TO CONTROL EMISSION FACTOR (LB./MMCF) CELL(N31)	HAP TO CONTROL EMISSION FACTOR (LB./MMCF) CELL(N33)

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0P PORTABLE PLANT INFORMATION

COMPANY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

PORTABLE EQUIPMENT OPERATING SITE INFORMATION

FIPS COUNTY NO.	PLANT NO.	PROJECT NO.	TYPE OF INSTALLATION/UNIT		
SITE OR LOCATION NAME		PERCENT OF TOTAL THROUGHPUT AT SITE (%)		FIRST DATE AT SITE	LAST DATE AT SITE
ADDRESS		**Period of Operation**	HOURS	DAYS	WEEKS
CITY		ZIP CODE +4	PHONE NUMBER WITH AREA CODE		

	Latitude	Longitude	UTM Coordinates			
Degrees			EASTING (M)	NORTHING (M)	ACC (M)	HORIZONTAL DATUM (CHECK ONE) ☐ NAD27 ☐ NAD83 ☐ WGS84
Minutes						
Seconds						

PORTABLE EQUIPMENT OPERATING SITE INFORMATION

FIPS COUNTY NO.	PLANT NO.	PROJECT NO.	TYPE OF INSTALLATION/UNIT		
SITE OR LOCATION NAME		PERCENT OF TOTAL THROUGHPUT AT SITE (%)		FIRST DATE AT SITE	LAST DATE AT SITE
ADDRESS		**Period of Operation**	HOURS	DAYS	WEEKS
CITY		ZIP CODE +4	PHONE NUMBER WITH AREA CODE		

	Latitude	Longitude	UTM Coordinates			
Degrees			EASTING (M)	NORTHING (M)	ACC (M)	HORIZONTAL DATUM (CHECK ONE) ☐ NAD27 ☐ NAD83 ☐ WGS84
Minutes						
Seconds						

PORTABLE EQUIPMENT OPERATING SITE INFORMATION

FIPS COUNTY NO.	PLANT NO.	PROJECT NO.	TYPE OF INSTALLATION/UNIT		
SITE OR LOCATION NAME		PERCENT OF TOTAL THROUGHPUT AT SITE (%)		FIRST DATE AT SITE	LAST DATE AT SITE
ADDRESS		**Period of Operation**	HOURS	DAYS	WEEKS
CITY		ZIP CODE +4	PHONE NUMBER WITH AREA CODE		

	Latitude	Longitude	UTM Coordinates			
Degrees			EASTING (M)	NORTHING (M)	ACC (M)	HORIZONTAL DATUM (CHECK ONE) ☐ NAD27 ☐ NAD83 ☐ WGS84
Minutes						
Seconds						

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.0S STACK/VENT INFORMATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	☐ Stack ☐ Vent	FOR A NON-CIRCULAR STACK: DIAMETER = (1.128A)^1/2 (A=CROSS-SECTIONAL AREA IN SQ FEET)
STACK/VENT NO.	STACK/VENT DESCRIPTION			% OF EMISSIONS RELEASED

STACK/VENT OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

HEIGHT (FT.)	DIAMETER (FT.)	TEMPERATURE (F)	VELOCITY (FT./MIN.)	FLOW RATE (CU FT./MIN.)	LIST OTHER POINTS SHARING THIS STACK/VENT

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	☐ Stack ☐ Vent	FOR A NON-CIRCULAR STACK: DIAMETER = (1.128A)^1/2 (A=CROSS-SECTIONAL AREA IN SQ FEET)
STACK/VENT NO.	STACK/VENT DESCRIPTION			% OF EMISSIONS RELEASED

STACK/VENT OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

HEIGHT (FT.)	DIAMETER (FT.)	TEMPERATURE (F)	VELOCITY (FT./MIN.)	FLOW RATE (CU FT./MIN.)	LIST OTHER POINTS SHARING THIS STACK/VENT

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	☐ Stack ☐ Vent	FOR A NON-CIRCULAR STACK: DIAMETER = (1.128A)^1/2 (A=CROSS-SECTIONAL AREA IN SQ FEET)
STACK/VENT NO.	STACK/VENT DESCRIPTION			% OF EMISSIONS RELEASED

STACK/VENT OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

HEIGHT (FT.)	DIAMETER (FT.)	TEMPERATURE (F)	VELOCITY (FT./MIN.)	FLOW RATE (CU FT./MIN.)	LIST OTHER POINTS SHARING THIS STACK/VENT

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	☐ Stack ☐ Vent	FOR A NON-CIRCULAR STACK: DIAMETER = (1.128A)^1/2 (A=CROSS-SECTIONAL AREA IN SQ FEET)
STACK/VENT NO.	STACK/VENT DESCRIPTION			% OF EMISSIONS RELEASED

STACK/VENT OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

HEIGHT (FT.)	DIAMETER (FT.)	TEMPERATURE (F)	VELOCITY (FT./MIN.)	FLOW RATE (CU FT./MIN.)	LIST OTHER POINTS SHARING THIS STACK/VENT

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	☐ Stack ☐ Vent	FOR A NON-CIRCULAR STACK: DIAMETER = (1.128A)^1/2 (A=CROSS-SECTIONAL AREA IN SQ FEET)
STACK/VENT NO.	STACK/VENT DESCRIPTION			% OF EMISSIONS RELEASED

STACK/VENT OPERATING STATUS (CHECK ONE) ☐ Active ☐ Inactive ☐ Dismantled

HEIGHT (FT.)	DIAMETER (FT.)	TEMPERATURE (F)	VELOCITY (FT./MIN.)	FLOW RATE (CU FT./MIN.)	LIST OTHER POINTS SHARING THIS STACK/VENT

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 2.0Z OZONE SEASON INFORMATION - EMISSIONS STATEMENT

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

OPERATING RATE/SCHEDULE (DURING PEAK OZONE SEASON ONLY)

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DAILY THROUGHPUT	UNITS

DAYS/WEEK	WEEKS OF OPERATION	START TIME ON TYPICAL DAY	END TIME ON TYPICAL DAY

EMISSIONS CALCULATIONS

Air Pollutant	Emission Factor	Control Efficiency (%)	Actual Emissions (lbs./day)
VOC			
NO_X			
CO			

OPERATING RATE/SCHEDULE (DURING PEAK OZONE SEASON ONLY)

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DAILY THROUGHPUT	UNITS

DAYS/WEEK	WEEKS OF OPERATION	START TIME ON TYPICAL DAY	END TIME ON TYPICAL DAY

EMISSIONS CALCULATIONS

Air Pollutant	Emission Factor	Control Efficiency (%)	Actual Emissions (lbs./day)
VOC			
NO_X			
CO			

OPERATING RATE/SCHEDULE (DURING PEAK OZONE SEASON ONLY)

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	DAILY THROUGHPUT	UNITS

DAYS/WEEK	WEEKS OF OPERATION	START TIME ON TYPICAL DAY	END TIME ON TYPICAL DAY

EMISSIONS CALCULATIONS

Air Pollutant	Emission Factor	Control Efficiency (%)	Actual Emissions (lbs./day)
VOC			
NO_X			
CO			

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.1 FUEL COMBUSTION WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA
EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)		SEG. NO.

1. COMBUSTION EQUIPMENT INFORMATION

COAL FIRING CODE LIST	EQUIPMENT DESCRIPTION	YEAR PUT IN SERVICE	COAL FIRING CODE NO. (CODE LIST AT LEFT)	MAXIMUM DESIGN RATE (MILLION BTU/HR.)
1. TANGENTIAL				
2. OPPOSED				
3. FRONT				
4. DRY/WET BOTTOM				
OTHER (SPECIFY)	Sum of total maximum hourly design rates			

COMBUSTION EQUIPMENT USE (CHECK ONE)

- ☐ Electric power generation
- ☐ Industrial use
- ☐ Commercial/Institutional
- ☐ Space heating
- ☐ Other (specify):

COMBUSTION EQUIPMENT CATEGORY - COAL USE ONLY (CHECK ONE)

- ☐ Pulverized coal
- ☐ Pulverized coal dry bottom
- ☐ Pulverized coal wet bottom
- ☐ Cyclone
- ☐ Fluidized bed
- ☐ Spreader stoker
- ☐ Overfeed stoker
- ☐ Underfeed stoker
- ☐ Hand fired
- ☐ Other (specify):

2. FUEL INFORMATION (CHECK ONLY ONE)

LIQUID FUELS	GASEOUS FUELS	SOLID FUELS	OTHER
☐ Ethanol	☐ Blast oven gas	☐ Anthracite Coal	☐ Other (specify):
☐ Fuel oil 1-4 (distillate)	☐ Coke oven gas	☐ Bagasse	
☐ Fuel oil 5-6 (residual)	☐ Liquid propane gas (LPG)	☐ Bark	
☐ Gasoline	☐ Natural gas	☐ Bituminous coal	
☐ Kerosene		☐ Coke	
		☐ Lignite	
		☐ Subbituminous coal	
		☐ Wood	

3. CALCULATION OF MAXIMUM HOURLY DESIGN RATE

TOTAL HEAT CONTENT (BTU/FUEL UNIT)	MAXIMUM HOURLY DESIGN RATE (FUEL UNIT/HR.)	$= \frac{\text{Maximum Design Rate (mmbtu/hr.)} \times \text{1,000,000 (btu/mmbtu)}}{\text{Heat Content (btu/fuel unit)}}$

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.2 INCINERATOR WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. EQUIPMENT INFORMATION

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SCC UNITS	SEG. NO.
MAXIMUM HOURLY DESIGN RATE	UNITS/HR.	MAKE / MODEL	SERIAL NUMBER

INCINERATOR USE (CHECK ONE):

☐ Government ☐ Commercial ☐ Institutional ☐ Industrial
☐ Other (specify):

EQUIPMENT TYPE (CHECK APPROPRIATE BOXES):

☐ Pathological ☐ Sewage sludge ☐ Multiple chambers ☐ Controlled air
☐ Other (specify):

NUMBER OF CHAMBERS NOT INCLUDING STACK	SECONDARY CHAMBER TEMPERATURE (F)

2. WASTE INFORMATION AND THROUGHPUTS

PROCESS WASTE TYPES	HEAT CONTENT (BTU/UNITS)	ANNUAL THROUGHPUT	UNITS
	Total annual throughput =		LBS./YR.
	Total annual throughput (TONS/YR.) = {Total annual throughput (LBS./YR.)} / 2,000		TONS/YR.

Enter the total annual throughput (TONS/YR.) into Section 3 on Form 2.0.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.3 VOC PROCESS MASS-BALANCE WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA
EMISSION UNIT NO.	SCC	SEG. NO.	

INSTRUCTIONS

If your facility already calculates your VOC or HAP emissions and emission factor directly through a spreadsheet or engineering calculation, this form is **optional** as long as you supply your supporting documentation. This form is designed for annual throughputs measured in **gallons or tons only.** If you use another unit of measure, supply documentation of how you calculated total emissions and an emission factor. Maintain copies of the Material Safety Data Sheet for each material listed and hazardous waste shipment reports for on-demand requests.

1. TOTAL ANNUAL THROUGHPUT AND TOTAL POUNDS OF VOC

APPLICATION METHOD	MATERIAL TYPE	[A] ANNUAL THROUGHPUT (ton/yr. or gal./yr.)	[B] MAXIMUM % BY WT. OF VOC IN MATERIAL	[C] DENSITY (LBS./UNIT) IF (A) IN TONS, (C)=2,000	[D] LBS. OF VOC PER UNIT (B) × (C) = (D)	[E] VOC (LBS./YR.) (A) × (D) = (E)
Enter the total annual throughput value [F] into Section [3], Annual Throughput on Form 2.0		[F] TOTAL ANNUAL THROUGHPUT				[G] TOTAL VOC (LBS./YR.)

2. CALCULATION OF POUNDS OF VOC RECOVERED

AMOUNT OF MATERIAL SHIPPED AS HAZARDOUS WASTE (LBS./YR.)	×	% VOC CONTENT OF WASTE	=	[H] LBS. OF VOC RECOVERED

3. CALCULATION OF POUNDS OF VOC EMITTED PRIOR TO CONTROL EQUIPMENT

[G] - [H] = [I]

[Total lbs. of VOC] - [lbs. of VOC recovered] =

[I] LBS. OF VOC EMITTED PRIOR TO CONTROL

4. CALCULATION OF EMISSION FACTOR

[I] / [F] = [J]

[lbs of VOC emitted prior to control equipment] / [Total annual throughput] =

Enter [J] on Form 2.0 as VOC EF

[J] EMISSION FACTOR IN LBS./UNIT

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 2.4 VOLATILE ORGANIC LIQUID LOADING WORKSHEET

Note: This form is used to calculate emissions from loading organic liquids into tank trucks, rail tank cars and barges.

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. LOADING INFORMATION

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.
ANNUAL THROUGHPUT OF LIQUID (1,000 GALLONS)	CONTROL DEVICE TYPE	CONTROL EFFICIENCY (%)

TYPE OF LOADING (CHECK ONE)

☐ Splash loading ☐ Submerged loading ☐ Bottom loading

☐ Other (specify):

2. CHEMICAL INFORMATION

BULK LIQUID TYPE	MOLECULAR WEIGHT OF MATERIAL LOADED [LB. / (LB./MOLE)]
TRUE VAPOR PRESSURE OF BULK LIQUID (PSIA)	SATURATION FACTOR

TEMPERATURE OF LIQUID (DEGREES RANKINE) = DEGREES FAHRENHEIT + 460 DEGREES FAHRENHEIT

3. LOADING LOSS EMISSION FACTOR CALCULATION

LOADING LOSS EMISSION FACTOR =

12.46 x (Molecular Weight) x (True vapor pressure) x (Saturation) / (Temperature in Degrees Rankine)

LOADING LOSS EMISSION FACTOR	UNITS
	lbs. per 1,000 gallons

NOTE

Enter the Control Efficiency (%) from Section 1 (above) into Section 5, Column 4 on Form 2.0.
Enter the Annual Throughput of Liquid from Section 1, expressed in thousands of gallons, into Section 3 on Form 2.0.
Enter the Loading Loss Emission Factor from Section 3 into the VOC box of Section 5, Column 2 on Form 2.0

Remember when calculating emissions, use a separate Form 2.0, *Emission Unit Information*, for each type of liquid loaded in the tank during the year.

Use the same unit number but with the Source Classification Code that corresponds to the different liquid type.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 2.5L GENERAL LIQUID STORAGE TANK INFORMATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

EMISSION UNIT NO.	TANK ID	SCC (BREATHING OR WORKING)	SEG. NO.	DIAMETER (FT.)	HEIGHT (FT.)	LENGTH (FT.)
CAPACITY (IN THOUSANDS OF GALLONS)		THROUGHPUT (IN THOUSANDS OF GALLONS)		TANKS PROGRAM USED? ☐ Yes ☐ No		
CAS NUMBER		CHEMICAL		CHOOSE TYPE OF TANK (CHECK ONE) ☐ Vertical fixed roof ☐ Vertical floating roof ☐ Horizontal fixed roof ☐ Underground		
EMISSION UNIT NO.	TANK ID	SCC (BREATHING OR WORKING)	SEG. NO.	DIAMETER (FT.)	HEIGHT (FT.)	LENGTH (FT.)
CAPACITY (IN THOUSANDS OF GALLONS)		THROUGHPUT (IN THOUSANDS OF GALLONS)		TANKS PROGRAM USED? ☐ Yes ☐ No		
CAS NUMBER		CHEMICAL		CHOOSE TYPE OF TANK (CHECK ONE) ☐ Vertical fixed roof ☐ Vertical floating roof ☐ Horizontal fixed roof ☐ Underground		
EMISSION UNIT NO.	TANK ID	SCC (BREATHING OR WORKING)	SEG. NO.	DIAMETER (FT.)	HEIGHT (FT.)	LENGTH (FT.)
CAPACITY (IN THOUSANDS OF GALLONS)		THROUGHPUT (IN THOUSANDS OF GALLONS)		TANKS PROGRAM USED? ☐ Yes ☐ No		
CAS NUMBER		CHEMICAL		CHOOSE TYPE OF TANK (CHECK ONE) ☐ Vertical fixed roof ☐ Vertical floating roof ☐ Horizontal fixed roof ☐ Underground		
EMISSION UNIT NO.	TANK ID	SCC (BREATHING OR WORKING)	SEG. NO.	DIAMETER (FT.)	HEIGHT (FT.)	LENGTH (FT.)
CAPACITY (IN THOUSANDS OF GALLONS)		THROUGHPUT (IN THOUSANDS OF GALLONS)		TANKS PROGRAM USED? ☐ Yes ☐ No		
CAS NUMBER		CHEMICAL		CHOOSE TYPE OF TANK (CHECK ONE) ☐ Vertical fixed roof ☐ Vertical floating roof ☐ Horizontal fixed roof ☐ Underground		
EMISSION UNIT NO.	TANK ID	SCC (BREATHING OR WORKING)	SEG. NO.	DIAMETER (FT.)	HEIGHT (FT.)	LENGTH (FT.)
CAPACITY (IN THOUSANDS OF GALLONS)		THROUGHPUT (IN THOUSANDS OF GALLONS)		TANKS PROGRAM USED? ☐ Yes ☐ No		
CAS NUMBER		CHEMICAL		CHOOSE TYPE OF TANK (CHECK ONE) ☐ Vertical fixed roof ☐ Vertical floating roof ☐ Horizontal fixed roof ☐ Underground		
EMISSION UNIT NO.	TANK ID	SCC (BREATHING OR WORKING)	SEG. NO.	DIAMETER (FT.)	HEIGHT (FT.)	LENGTH (FT.)
CAPACITY (IN THOUSANDS OF GALLONS)		THROUGHPUT (IN THOUSANDS OF GALLONS)		TANKS PROGRAM USED? ☐ Yes ☐ No		
CAS NUMBER		CHEMICAL		CHOOSE TYPE OF TANK (CHECK ONE) ☐ Vertical fixed roof ☐ Vertical floating roof ☐ Horizontal fixed roof ☐ Underground		

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 2.7 HAUL ROAD FUGITIVE EMISSIONS WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

INSTRUCTIONS

This worksheet is **optional**	If the sum of all Vehicle Miles Traveled, or VMT, at the facility is less than 100, this form is not necessary and the emission unit should be marked as insignificant on Form 1.2.
	If the haul road parameters are the same as last year and the updated emission factor equation is used (AP-42, Section 13.2.2, *Unpaved Roads* , Nov. 2006), enter the current annual VMT as the throughput on Form 2.0.

Do not calculate a separate emission factor for each vehicle class. Use the weighted average for the entire fleet traveling the haul road to calculate the emission factors.

1. HAUL ROAD INFORMATION

EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.

LENGTH OF ROAD (MILES): IF ONE-WAY, DIVIDE BY 2

SILT CONTENT (%) (DEFAULT = 8.3%)	SURFACE MATERIAL OF ROAD

DAYS OF RAIN WITH AT LEAST 0.01" PER YEAR (DEFAULT = 105)

Type of Dust Control (check one)	Control Efficiency
☐ Paved with Washing	95%
☐ Paved	90%
☐ Surfactant Spray	90%
☐ Water Spray Documented	90%
☐ Water Spray	50%
☐ Other - Specify	
☐ No Controls	0%

2. HAUL TRUCK INFORMATION

MAKE/MODEL	UNLOADED TRUCK WEIGHT (TONS) — WEIGHTED AVERAGE FOR FLEET
AVERAGE WEIGHT OF MATERIAL PER LOAD (TONS)	AVERAGE LOADED WEIGHT (TONS) — WEIGHTED AVERAGE FOR FLEET

3. MATERIAL HAULED

TYPE OF MATERIALS HAULED	ANNUAL AMOUNT HAULED (TONS)

4. CALCULATION OF ANNUAL VEHICLES MILES TRAVELED

ANNUAL VMT

$$\text{Annual VMT} = \frac{2 \times (\text{Length of road}) \times (\text{Annual amount hauled})}{(\text{Average weight of material per load})}$$

5. CALCULATION OF HAUL ROAD UNCONTROLLED EMISSION FACTOR

$PM_{2.5}$ Emission Factor	$0.15 \times \left(\frac{\text{Silt Content \%}}{12}\right)^{0.9} \times \left(\frac{\text{Unloaded truck weight + Loaded truck weight (tons)}}{6}\right)^{0.45} \times \left(\frac{365 - \text{Days of Rain}}{365}\right)$	$PM_{2.5}$ EMISSION FACTOR
PM_{10} Emission Factor	$1.5 \times \left(\frac{\text{Silt Content \%}}{12}\right)^{0.9} \times \left(\frac{\text{Unloaded truck weight + Loaded truck weight (tons)}}{6}\right)^{0.45} \times \left(\frac{365 - \text{Days of Rain}}{365}\right)$	PM_{10} EMISSION FACTOR

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 2.8 STORAGE PILE WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. STORAGE PILE INFORMATION

EMISSION UNIT NO.		SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	TYPE OF MATERIAL STORED
	ACTIVITY			
	WIND EROSION			

MOISTURE CONTENT (%) (DEFAULT = 0.7%)	AREA OF STORAGE PILE (ACRES)	
SILT CONTENT(%) (DEFAULT = 1.6%)	RAW MATERIAL LOADING METHOD (CHECK ONE): ☐ Barge ☐ Rail ☐ Truck ☐ Conveyor ☐ Other (specify) ______	RAW MATERIAL UNLOADING METHOD (CHECK ONE): ☐ Barge ☐ Rail ☐ Truck ☐ Conveyor ☐ Other (specify) ______
STORAGE DURATION (DAYS)		
ANNUAL AMOUNT STORED (TONS)		
MAXIMUM HOURLY AMOUNT STORED (TONS)		

2. OTHER FACTORS AFFECTING EMISSION RATES

MEAN WIND SPEED (MPH) (DEFAULT = 10 MPH)	% OF TIME WIND > 12 MPH (DEFAULT = 32%)
DRY DAYS PER YEAR (DEFAULT = 260 DAYS)	VEHICLE ACTIVITY FACTOR (DEFAULT = 1.0)

4. STORAGE PILE EMISSION FACTOR CALCULATIONS

CALCULATION	FORMULA	RESULT
[3-A-1] Load In - Load Out Component (lb./ton)	0.0032 x .35 x (Mean wind speed / 5) ^1.3 / (Moisture content % / 2) ^1.4	
[3-A-2] Vehicle Activity Component (lb./ton)	0.05 x (Silt content % / 1.5) x (Dry days per year / 235) x Vehicle Activity Factor	
[3-A-3] Activity PM10 Emission Factor (lb./ton)	[3-A-1] Load In - Load Out Component + [3-A-2] Vehicle Activity Component	
[3-B] Wind Erosion PM10 Emission Factor (lb./acre-yr.)	0.85 x (Silt content % / 1.5) x (Storage duration (Days)) x (Dry days per year / 235) x (% of time wind >12 MPH /15)	

NOTE

If you use a Source Classification Code and emission factor from the list in the instructions for this form, make sure to complete Section 1, Storage Pile Information for each storage pile.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 2.9 STACK TEST/CONTINUOUS EMISSIONS MONITOR WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA
EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)	SEG. NO.	STACK NO.
TYPE ☐ CEM ☐ Stack test	POLLUTANT TESTED	CAS NUMBER	Note: Use a separate worksheet for each pollutant tested.

1. EMISSION SOURCE INFORMATION

EQUIPMENT MAKE/MODEL
TYPE OF CONTROL DEVICE
LIMITATIONS ON EMISSIONS, PRODUCTION OR OPERATING TIME (IF ANY)

2. STACK TEST INFORMATION

TESTING FIRM NAME			
TESTING FIRM ADDRESS	CITY	STATE	ZIP CODE + 4
EPA METHOD(S) USED	TEST DATE(S)	RESULTS	COMPLIANCE ☐ Yes ☐ No

TEST TECHNIQUE (CHECK ONE) ☐ Operational Rate ☐ Maximum Design Rate ☐ Both	LATEST CALIBRATION OF TESTING EQUIPMENT
AGENCY OBSERVING TEST (CHECK ONE) ☐ EPA ☐ DNR ☐ Other	NAME OF OBSERVER(S)

3. CONTINUOUS EMISSION MONITORING INFORMATION

CONCENTRATION OF POLLUTANT	UNITS	FLOW RATE OF STACK	UNITS
LATEST CALIBRATION OF MONITOR		RESULTS OF CALIBRATION	
MONITOR AVERAGING PERIOD		PERCENT MONITOR DOWN TIME	

4. EMISSION FACTOR CALCULATION

EMISSION RATE	UNITS LBS./HR.	Note: Documentation should include summary page information from the test data to verify the emission and production rate.
PRODUCTION RATE	UNITS/HR.	

EMISSION FACTOR =
[{EMISSION RATE} / {PRODUCTION RATE}]

EMISSION FACTOR	UNITS

Enter the emission factor into the appropriate box in Section 5, Column 3 on Form 2.0.
If applicable, enter the control device type and control efficiency (%) in Section 5 on Form 2.0.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 2.T HAZARDOUS AIR POLLUTANT WORKSHEET

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA
EMISSION UNIT NO.	SOURCE CLASSIFICATION CODE (SCC)		SEG. NO.

Use this form to report any Hazardous Air Pollutant, or HAP, which is emitted in any amount greater than the chemical reporting levels per each emission unit. The instructions for this form provide a list of the HAPs regulated under the Clean Air Act. The amount emitted (Column 4) should be reported before control equipment reductions are applied. Provide documentation (other worksheets, etc.) if the amount in Column 3 does not equal the amount in Column 4. The HAP reporting levels per emission unit are as follows: Category 1 HAPs - sum of 20 pounds per year; All other HAPs - sum of 200 pounds per year.

1. HAP CHEMICAL	2. CAS NUMBER	3. AMOUNT USED OR HANDLED (LBS./YR.)	4. UNCONTROLLED AMOUNT EMITTED (LBS./YR.)	5. UNCONTROLLED EMISSIONS REPORTED AS VOC OR PM10 (LBS./YR.)	6. UNCONTROLLED EMISSIONS REPORTED AS HAPs (LBS./YR.)	7. HAP CONTROL DEVICE(S)	8. CONTROL EFFICIENCY (%)	9. CONTROLLED EMISSIONS REPORTED AS VOC OR PM10 (LBS./YR.)	10. CONTROLLED EMISSIONS REPORTED AS HAPs (LBS./YR.)
		HAP Emission Totals =		SUM (LBS./YR.)	SUM (LBS./YR.)			SUM (LBS./YR.)	SUM (LBS./YR.)
Uncontrolled HAP Emission Factor =		Sum of uncontrolled emissions reported as HAPs (Column 6 Total)/Annual Throughput (Form 2.0)			11. HAP EMISSION FACTOR				

Enter the HAP emission factor for all chemicals that are not reported as VOCs or PM10 from Block 11 above as the HAP Emission Factor in Section 5 on Form 2.0.

MO 780-1448 (12-09)

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 3.0 EMISSIONS FEE CALCULATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. EMISSION UNIT NO. / SCC	Use one row to list the emissions from one emission unit. Sum the emissions in the page total box at the bottom of the column. If more than one page is needed, use the first row of the duplicated page to list the page totals from this page. Express figures in tons per year and round to two decimal places.								
	AIR POLLUTANT								
	PM_{10}	SO_X	NO_X	VOC	CO	LEAD	HAPs	$PM_{2.5}$	NH_3
PAGE TOTALS									

Note: Fill out the lower portion of this form one time only.

2. ACTUAL EMISSIONS (Use the sum of all page totals for each pollutant for actual emission figures below.)

	PM_{10}	SO_X	NO_X	VOC	CO	LEAD	HAPs	$PM_{2.5}$	NH_3
Total									

Copy the actual emissions from section 2 to the appropriate box(es) in the Total Plant Emissions Section of *Form 1.0 General Plant Information*.

3. CHARGEABLE EMISSIONS (Maximum 4,000 Tons/Yr. cap per pollutant)

Total					NO FEES FOR CO			NO FEES FOR $PM_{2.5}$	NO FEES FOR NH_3

4. SUM OF CHARGEABLE EMISSIONS SUBJECT TO FEES

Round chargeable emissions to the nearest whole ton. The minimum emission tonnage is one ton, and the maximum is 12,000 tons per year.	Tons/Yr.

5. TOTAL ANNUAL EMISSIONS FEE

Multiply the sum of chargeable emissions as calculated in section 4 by $40 and enter this amount in section 5. The minimum fee is $40.	$

6. ANNUAL EMISSIONS FEE REMITTED TO THE CITY OF KANSAS CITY OR ST. LOUIS COUNTY LOCAL AIR AGENCY

CHECK NUMBER	CHECK DATE	AMOUNT REMITTED IN CALENDAR YEAR OF RECORD

7. ANNUAL EMISSIONS FEE REMITTED TO THE STATE (SECTION 5 MINUS SECTION 6)

CHECK NUMBER	CHECK DATE	CHECK AMOUNT
		$

8. INCLUDE A CHECK FOR THE AMOUNT IN SECTION 7, PAYABLE TO THE MISSOURI AIR POLLUTION CONTROL PROGRAM.

Mail the check for the emissions fee to the State Air Agency listed on Form 1.0.

9. SEND THE COMPLETED QUESTIONNAIRE AND ANY SUPPORTING DOCUMENTATION TO THE AGENCY LISTED AT THE BOTTOM OF *FORM 1.0 GENERAL PLANT INFORMATION*.

Facilities within local air program jurisdiction only need to include copies of *Form 1.0 General Plant Information*, *Form 3.0 Emissions Fee Calculation* and *Form 4.0 Financial Cost Estimate* with the emissions fee check.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ

FORM 3.0 PART 70 OPERATING PERMIT EMISSIONS FEE CALCULATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. EMISSION UNIT NO. / **SCC**	Use one row to list the emissions from one emission unit. Sum the emissions in the page total box at the bottom of the column. If more than one page is needed, use the first row of the duplicated page to list the page totals from this page. Express figures in tons per year and round to two decimal places.									
	AIR POLLUTANT									
	PM_{10} FIL	**SO_X**	**NO_X**	**VOC**	**CO**	**LEAD**	**HAPs**	**$PM_{2.5}$ FIL**	**NH_3**	**PM CON**
PAGE TOTALS										

Note: Fill out the lower portion of this form one time only.

2. ACTUAL EMISSIONS (Use the sum of all page totals for each pollutant for actual emission figures below.)

	PM_{10} TOTAL	**SO_X**	**NO_X**	**VOC**	**CO**	**LEAD**	**HAPs**	**$PM_{2.5}$ TOTAL**	**NH_3**	**PM CON**
Total										Included in Total PM_{10} and $PM_{2.5}$

Copy the actual emissions from section 2 to the appropriate box(es) in the Total Plant Emissions Section of *Form 1.0 General Plant Information*.

3. CHARGEABLE EMISSIONS (Maximum 4,000 Tons/Yr. cap per pollutant.)

Total					**NO FEES FOR CO**			**NO FEES FOR $PM_{2.5}$**	**NO FEES FOR NH3**	PM CON is included in PM_{10} and $PM_{2.5}$

4. SUM OF CHARGEABLE EMISSIONS SUBJECT TO FEES

Round chargeable emissions to the nearest whole ton. The minimum emission tonnage is one ton, and the maximum is 12,000 tons per year.	

5. TOTAL ANNUAL EMISSIONS FEE

Multiply the sum of chargeable emissions as calculated in section 4 by $40 and enter this amount in section 5. The minimum fee is $40.	**$**

6. ANNUAL EMISSIONS FEE REMITTED TO THE CITY OF KANSAS CITY OR ST. LOUIS COUNTY LOCAL AIR AGENCY

CHECK NUMBER	CHECK DATE	AMOUNT REMITTED IN CALENDAR YEAR OF RECORD

7. ANNUAL EMISSIONS FEE REMITTED TO THE STATE (SECTION 5 MINUS SECTION 6)

CHECK NUMBER	CHECK DATE	CHECK AMOUNT
		$

8. INCLUDE A CHECK FOR THE AMOUNT IN SECTION 7, PAYABLE TO THE MISSOURI AIR POLLUTION CONTROL PROGRAM.

Mail the check for the emissions fee to the State Air Agency listed on *Form 1.0 General Plant Information*.

9. SEND THE COMPLETED QUESTIONNAIRE AND ANY SUPPORTING DOCUMENTATION TO THE AGENCY LISTED AT THE BOTTOM OF *FORM 1.0 GENERAL PLANT INFORMATION*.

Facilities within local air program jurisdiction only need to include copies of *Form 1.0 General Plant Information*, *Form 3.0 Emissions Fee Calculation* and *Form 4.0 Financial Cost Estimate* with the emissions fee check.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 3.0 CK CHARCOAL KILN EMISSIONS FEE CALCULATION

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

1. EMISSION UNIT NO / SCC	Use one row to list the emissions from one emission unit. Sum the emissions in the page total box at the bottom of the column. If more than one page is needed, use the first row of the duplicated page to list the page totals from this page. Express figures in tons per year and round to two decimal places.								
	AIR POLLUTANT								
	PM_{10}	SO_X	NO_X	VOC	CO	LEAD	HAPs	$PM_{2.5}$	NH_3
PAGE TOTALS									

Note: Fill out the lower portion of this form one time only.

2. ACTUAL EMISSIONS (Use the sum of all page totals for each pollutant for actual emission figures below.)

	PM10	SO_X	NO_X	VOC	CO	LEAD	HAPs	PM2.5	NH_3

Copy the actual emissions from section 2 to the appropriate box(s) in the Total Plant Emissions section of Form 1.0.

3. CHARGEABLE EMISSIONS (Maximum 4,000 Tons/Yr. cap per pollutant)

					NO FEES FOR CO			NO FEES FOR PM2.5	NO FEES FOR NH3

4. SUM OF EMISSIONS

Round figure to nearest ton per year

Tons/Yr.

5. TOTAL ANNUAL EMISSIONS FEE

Facilities that produce charcoal from wood are exempt from fees.

6. INCLUDE A CHECK FOR THE AMOUNT IN BOX 5, PAYABLE TO THE MISSOURI AIR POLLUTION CONTROL PROGRAM.

Mail the check for the emissions fee to the State Air Agency listed on Form 1.0.

7. SEND THE COMPLETED QUESTIONNAIRE AND ANY SUPPORTING DOCUMENTATION TO THE AGENCY LISTED AT THE BOTTOM OF FORM 1.0.

Facilities within local air program jurisdiction only need to include copies for Form 1.0, 3.0 and 4.0 with the emissions fee check.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
FORM 4.0 FINANCIAL COST ESTIMATE

FACILITY NAME	FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA

The Missouri Air Conservation Law, Chapter 643, requires a financial cost estimate. The cost estimate is an evaluation of any additional costs of doing business attributable to the Federal Clean Air Act, as amended.

Calculate the cost and expenses incurred to complete the Emission Inventory Questionnaire, including the calculation of emission fees. If you hired an outside consultant, include the time and money charged to your company. Also include any cost incurred if you installed air pollution control equipment, any additional monitoring or testing expense or any additional personnel costs incurred to comply with the Missouri Air Conservation Law and the Federal Clean Air Act, as amended.

Be sure to use the codes found in the instructions: www.dnr.mo.gov/env/apcp/eiq/eiqinformation.htm .

CATEGORY REPORTING	CODE FOR PERSONNEL OR EQUIPMENT	NUMBER OF EMPLOYEES	TOTAL NUMBER OF HOURS REQUIRED	COST PER HOUR	TOTAL COST
1. EIQ reviewed and completed by company personnel (engineers, technical specialists, others).					
2. EIQ completed by outside engineering consultants.					
3. Pollution control equipment, monitoring, or testing (List items separately).					
4. Estimate of the number of jobs added to implement the Federal Clean Air Act, as amended.					
5. Personnel and other costs associated with complying with the Clean Air Act, as amended, not included above.					
Total					

REMARKS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM

EMISSIONS INVENTORY QUESTIONNAIRE, OR EIQ
DRY CLEANER - NON-CHLORINATED AND PETROLEUM BASED SOLVENTS

FIPS COUNTY NO.	PLANT NO.	COUNTY	EMISSION UNIT NO.	SCC	SEG. NO.	YEAR OF DATA

1. DRY CLEANER INFORMATION

FACILITY NAME	CONTACT PERSON NAME/TITLE	PHONE NUMBER WITH AREA CODE	FAX NUMBER WITH AREA CODE

STREET ADDRESS	CITY	STATE	ZIP CODE +4

MAILING ADDRESS (IF DIFFERENT FROM ABOVE)	CITY	STATE	ZIP CODE +4

2. PARENT COMPANY INFORMATION

PARENT COMPANY NAME	OWNER'S PHONE NUMBER WITH AREA CODE

STREET ADDRESS, P.O. BOX OR ROUTE NUMBER	FAX NUMBER WITH AREA CODE

CITY	STATE	ZIP CODE +4

3. MACHINE INFORMATION

NUMBER OF DRY TO DRY MACHINES	NUMBER OF TRANSFER MACHINES	TOTAL COMBINED DRYER CAPACITY
		Lbs.

4. SOLVENT DETAIL

SOLVENT TYPE (CHECK ONE)

☐ Stoddard ☐ Other (specify):

Calculate Solvent Use	Non-Chlorinated (Non-perc)
Gallons on hand from previous year	
Gallons brought on-site during calendar year (+)	
Unused gallons transferred off-site (-)	
Gallons on hand at end of calendar year (-)	
(a) Total gallons used during calendar year (=)	

5. CALCULATE GALLONS SOLVENT SHIPPED AS WASTE

Number of Filters	×	Conversion Factor (Default = 0.1)	=	**(b)**	Gallons of Sludge	×	0.1	=	**(c)**

6. CALCULATE AIR EMISSIONS FEE

$\frac{[a-b-c] \times \text{Solvent Density}}{2{,}000 \text{ pounds per ton}}$	Solvent Density lbs./gal. Stoddard: 6.316 Other:	**1.**	Tons/Yr.
One ton minimum used to calculate fees (See instructions for current fee schedule).	Tons/Yr. (rounded to the nearest whole number) × Emission Fee	**2.**	$

7. CERTIFICATION

The undersigned certifies that they have personally examined and are familiar with the information and statements contained herin and further certifies they believe this information is true, accurate and complete. The undersigned certifies that knowingly making a false statement or misrepresenting the facts presented in this document is a violation of state law.

PRINTED NAME AND TITLE OF PERSON COMPLETING FORM	SIGNATURE OF PERSON COMPLETING FORM	DATE
PRINTED NAME AND TITLE OF AUTHORIZED COMPANY REPRESENTATIVE	SIGNATURE OF AUTHORIZED COMPANY REPRESENTATIVE	DATE

CHECK INFORMATION				**OFFICE USE ONLY**	
EMISSION FEE	CHECK AMOUNT	CHECK DATE	CHECK NO.	LOGGED IN BY	DATE RECEIVED

Appendix B-2

CenSARA Agricultural Pesticide Tool

The tool documentation included appendices A through E, and G through I, which were listings of non-Missouri emissions by county and SCC. To conserve space, only Appendix F with Missouri's detailed emissions is retained, along with Appendix J with average VOC emission factors.

PESTICIDE APPLICATIONS – 2011 EMISSIONS INVENTORY ENHANCEMENT PROJECT

Contract Number: 11-1125-MSO-059

October 2012

Prepared for:

Ms. Theresa Pella
Central States Air Resources Agencies
707 N. Robinson
P.O. Box 617
Oklahoma City, OK 73101-0617

Prepared by:

Mr. Juan A. Maldonado
TranSystems Corporation
5528-B Hempstead Way
Springfield, VA 22151

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The data in this final report and accompanying tool should be considered preliminary and under review by the states. For final 2011 NEI data, please contact the individual state.

CHAPTER I. INTRODUCTION

Under the Air Emissions Reporting Rule (AERR), states must prepare and submit to the U.S. Environmental Protection Agency (EPA) emission inventories representing all source categories for calendar year 2011 as part of the National Emissions Inventory (NEI). The Central States Air Resources Agencies (CenSARA) identified three area source categories for which emission inventory improvements were warranted, including oil and gas extraction, area combustion sources, and agricultural pesticides. The purpose of this project was to assist CenSARA in preparing an improved emissions inventory for agricultural pesticide use at the county level.

CenSARA is the regional planning organization (RPO) that covers the states and tribal areas of Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, Oklahoma, and Texas. The states that make up the CenSARA region are important contributors to the agricultural industry. With over 140 million acres of crops harvested each year, pesticide use (e.g., herbicide, insecticide, fungicide) is widespread and its potential impact on air quality significant. CenSARA's goal was to obtain activity data for row and non-row crop pesticide use at the county level and quantify volatile organic compounds (VOC) and hazardous air pollutants (HAPs) emissions. Non-agricultural pesticide applications were not included in the scope of this project.

TranSystems Corporation (TranSystems) gathered agricultural data from the U.S. Department of Agriculture's National Agricultural Statistics Services to determine the amount of active ingredient associated with each crop at the county level. Pesticide formulation data was obtained from the California Department of Pesticide Regulations and used to develop active ingredient specific emission factors. Given that pesticide application emissions are seasonal, CenSARA and TranSystems circulated a survey among state agriculture experts for their feedback on typical pesticide application schedules. As the primary product of this project, TranSystems also developed and delivered to CenSARA a Microsoft Access application modeling pesticide emissions in the CenSARA states in calendar year 2011 and designed to model pesticide application emissions in subsequent years.

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CHAPTER II. METHODOLOGY

Formulations of pesticides are made through the combination of the pest-killing material referred to as the active ingredient, and various solvents (which act as carriers for the pest-killing material) referred to as the inert ingredient. Both types of ingredients contain volatile organic compounds (VOC) that can potentially be emitted to the air either during application or as a result of evaporation. The basic framework for estimating VOC emissions was taken from the State and Territorial Air Pollution Program Administrators (STAPPA)/Association of Local Air Pollution Control Officials (ALAPCO)-EPA Emission Inventory Improvement Program (EIIP) Document Series – Volume III, Chapter 9, alternative method 1 (9.5-2) (EIIP, 2001).

The variation adopted in this inventory relates to the determination of the VOC emission factor. The EIIP method correlates VOC to the mass of pesticide applied whereas the method correlates VOC emissions to the mass of active ingredient applied. Modification of the standard method was needed because application data in terms of pesticide product mass is not available from the U.S. Department of Agriculture (USDA) National Agriculture Statistics Service (USDA, 2012a). What the USDA reports is the mass of active ingredient applied at the state level. County level active ingredient throughput is derived from state/regional application rates multiplied by number of acres treated for a given crop. The standard method also assumes that 90 percent of pesticide VOC content derived from product formulation evaporates. Because the emission factors developed in this study were derived from empirical studies that account for the effect of non-volatile organic content, the 90 percent evaporation rate was excluded from the EIIP equation 9.5-2. Total modified pesticide emissions formula is shown in equation II-1:

$$E_{Prod} = \sum_{i,c,k}(I_{i,k} \times A_c \times T_{i,k} \times EF\_VOC_{Avg_i}) \qquad \text{(Eq. II-1)}^1$$

where:

E_{Prod}	=	total regional emissions from pesticide product applications in pounds
$EF\_VOC_{Avg_i}$	=	average VOC content expressed in pounds of VOC per pound of active ingredient *i* applied;
$I_{i,k}$	=	pounds of active ingredient *i* applied per year per crop-acre in state *k*;
A_c	=	total crop-acres in county *c;*
$T_{i,k}$	=	percent of state crop-acres treated with active ingredient *i*

A. DEVELOPMENT OF THE VOC EMISSION FACTORS

The VOC emission factor is derived for each active ingredient based on the pesticide profiles database maintained by the California Department of Pesticide Regulation (DPR, 2012). The California Department of Pesticide Regulation's (CA DPR) database contains the chemical formulation for pesticides registered in the State of California and provides key inputs for the development of the enhanced VOC emission factor. These key inputs include:

- mass fraction of each active ingredient;
- mass fraction of inactive ingredients; and
- the emission potential (EP) of registered pesticide products.

The EP value represents the VOC content of the pesticide product including HAP per unit mass of pesticide product applied and it is determined empirically through thermogravimetric analysis (TGA). About 90 percent of pesticide products in California have had their EP value determined by TGA (DPR, 2008). Because the CA DPR database lists both agricultural and non-agricultural pesticide products, it was necessary to screen out entries that were likely formulated as a consumer product. It was assumed that pesticide products containing 99% of inert ingredient by

[1] Equation II-1 is inclusive of both VOC and HAP emissions. Please refer to Section II.B describing how HAP emissions were differentiated from VOC emissions.

mass were consumer products. Additionally, pesticide products that contained terms suggesting non-agricultural applications were excluded. Terms used to screen out likely consumer product are listed in Table II-1.

Table II-1. Terms Utilized to Filter Non-Agriculture Related Products

ALGAE	DEODORIZING	GERM	MRSA	SANITIZER
ANT	DETERGENT	HAMSTER	ORNAMENTAL	SPA
BATHROOM	DISHWASHER	HORNET	POND	STAIN
BEDBUG	DISINFECT	HORSE	POTTY	SWIM
BEE	DOG	HOUSE	PRESCRIPTION	TICK
CATTLE	DRAIN	INDOOR	RAT	TURF
CLEANER	FLEA	KLEEN	ROACH	WASP
DECK	FLY	LANDSCAPE	RODENTICIDE	WIPES
DEGREASER	FOGGER	LAWN	ROOF	YARD
DEODORIZER	GERBIL	MOUSE	SANI-	

The EP value is expressed in terms of VOC mass per unit mass of pesticide. Given that the mass of active ingredient applied is known but the mass of pesticide product applied is unknown, it was necessary to correlate the VOC content of the pesticide to the mass content of its active ingredients. The derivation of the active ingredient VOC emission factor from the EP value is as shown in Equations II-2a through Equation II-2c.

$$VOC_{m_j} = EP_j \times P_j = EP_j \sum_{i=1}^{n} \frac{F_{i,j}}{F_{total_j}} \times P_j = \sum_{j=1}^{n} VOC_{m_{i,j}} \qquad \text{(Eq. II-2a)}$$

$$VOC_{m_{i,j}} = EP_j \times \frac{F_{i,j}}{F_{total_j}} \times P_j = EP_j \times \frac{I_{i,j}}{F_{total_j}} \qquad \text{(Eq. II-2b)}$$

$$EF\_VOC_{i,j} = \frac{VOC_{m_{i,j}}}{I_{i,j}} = \frac{EP_j}{F_{total_j}} \qquad \text{(Eq. II-2c)}$$

where:

EP_j	=	VOC emission potential for pesticide *j*, known from CA DPR database;
F_{total_j}	=	summed fraction of all active ingredients in the pesticide *j*, known from CA DPR database;
$F_{i,j}$	=	fraction of active ingredient *i* in pesticide *j*, known from CA DPR database;
$I_{i,j}$	=	mass of active ingredient *i* in pesticide j applied, known;
P_j	=	total mass of a pesticide *j*, unknown;
$VOC_{m_{i,j}}$	=	mass of VOC emissions from pesticide j calculated based on mass of active ingredient i applied;
VOC_{m_j}	=	total mass of VOC emissions from pesticide *j*;
$EF\_VOC_{i,j}$	=	VOC emission factor of pesticide *j* expressed as VOC mass per unit mass of active ingredient *i*;
n	=	total number of active ingredients in the pesticide *j*;

The emission factor in Equation II-2c was further adjusted as to make the emission factor dependent on the active ingredient alone (see Equation II-3). Moreover, the average VOC emission factor was derived from pesticide products that contained at least one active ingredient that was also reported by USDA as being utilized in CenSARA states. In total, 458 active ingredient specific VOC emission factors were developed from the CA DPR database, of which 281 corresponded to active ingredients utilized in the CenSARA region based on reported active ingredient applications from USDA (USDA, 2012a).

$$EF\_VOC_{Avg_i} = \frac{\sum_{j=1}^{q} EF\_VOC_{i,j}}{q} \qquad \text{(Eq. II-3)}$$

where:

$EF\_VOC_{Avg_i}$	=	average VOC emission factor *j* expressed as VOC mass per unit mass of active ingredient *i*;
$EF\_VOC_{i,j}$	=	VOC emission factor of pesticide *j* expressed as VOC mass per unit mass of active ingredient *i*;
q	=	total number of pesticides with active ingredient *i*.

For active ingredients not in the DPR database, a weighted average emission factor was used. This weighted average was estimated by weighting the emission factors in the DPR database using the total pounds of active ingredient reported in the National Agricultural Statistics Service (NASS) pesticide use data resulting in a value of 1.2 pounds of VOC per pound of active ingredient.

Emission factors were compared with similar studies conducted in Maryland (MDE, 2002) and Kansas to check for consistency (Deahl, 2012). Table II-2 summarizes the comparison. Although each study has a unique methodology and a direct comparison is not feasible, some general observations can be made. First, CenSARA's average emission factor is larger than that of the two other studies. Also, the number of active ingredients contemplated in the CenSARA study is the largest by an order of magnitude, which indicates that emission estimates are highly stratified and thus the characterization of emissions is more defined. Third, the average emission factor values fall between +25.6% and -22.8% of the mean average emission factor.

Table II-2. VOC Emission Factor Comparison with Prior State Studies

Study	Count of Active Ingredients	Average VOC Emission Factor (lbs VOC/lbs Active Ingredient)	Mean Average VOC Emission Factor (lbs VOC/lbs Active Ingredient)	Deviation from the mean
CenSARA	458	1.557	1.239	+25.6%
Maryland	54	0.956		-22.8%
Kansas	20	1.203		-2.9%

Table II-3 compares the apparent VOC emission factor calculated as the ratio of state VOC emissions to total active ingredient mass with the comparable VOC emission factor used in the 2008 NEI. It was noted that the apparent VOC emission factors for 2011 were consistently higher than the NEI emission factor value for 2008. The latter is a constant value because the 2008 methodology assumes a default national VOC emission factor (see Table II-3).

Table II-3. VOC Emission Factor Comparison with 2008 NEI

State	2008 NEI (lbs VOC/lbs Active Ingredient)	2011 CenSARA (lbs VOC/lbs Active Ingredient)	Difference
Arkansas	0.751	0.991	32%
Iowa	0.751	1.266	69%
Kansas	0.751	1.075	43%
Louisiana	0.751	0.908	21%
Minnesota	0.751	1.310	74%
Missouri	0.751	1.122	49%
Nebraska	0.751	1.134	51%
Oklahoma	0.751	0.843	12%
Texas	0.751	0.902	20%

B. DEVELOPMENT OF THE HAP EMISSION FACTORS

For the estimation of HAP emissions, a variation of the EIIP's preferred method (9-4.1) based on vapor pressure of the active ingredient was implemented. The subset of HAPs was extracted from the list of active ingredient by CAS number, and is shown in Table II-2. The emissions from the HAP active ingredients were estimated as follows.

$$E_{HAP} = \sum_{h,c,k} I_{h,k} \times A_c \times T_{h,k} \times EF_h \qquad \text{(Eq. II.-4)}$$

where:

E_{HAP} = HAP emissions from pesticide product applications in pounds;
$I_{h,k}$ = pounds of HAP active ingredient *h* applied per year per crop-acre in state *k*;
A_c = total crop-acres in county *c*;
$T_{h,k}$ = percent of acres treated with active HAP ingredient *h* in state *k*;
EF_h = emission factor from EIIP Table 9.4-4 based on vapor pressure of HAP active ingredient *h* in pounds of emission per pound of active ingredient.

Note that pesticide emissions calculated using Equation II-1 are inclusive of HAPs emissions. To split HAP and non-HAP VOC emissions from total pesticide emissions it is necessary to subtract HAP emissions from total pesticide product emissions as shown in Equation II-5.

$$E_{VOC} = E_{Prod} - E_{HAP} \qquad \text{(Eq. II-5)}$$

where:

E_{Prod} = total emissions from pesticide product applications in pounds using Equation II-1;
E_{HAP} = HAP emissions from pesticide product applications in pounds using Equation II-4;
E_{VOC} = VOC emissions (excluding HAPs) from pesticide product applications in pounds.

Table II-2. HAPs Linked to Pesticide Use in the CenSARA Region

Active Ingredient	Pesticide Code	CAS Number
2,4-Dichlorophenoxy Acetic Acid	30001	94-75-7
2,4-Dichlorophenoxy Acetic Acid	30053	94-75-7
Captan	81301	114-26-1
Carbaryl	56801	7778-39-4
Phosphorus Compounds	59101	78-93-3
Methyl Iodide	11	133-06-2
Lindane (All isomers)	9001	63-25-2
Methyl Bromide	53201	2921-88-2
Pentachloronitrobenzene	56502	62-73-7
Trifluralin	36101	56-38-2

CHAPTER III. ACTIVITY DATA

CenSARA states do not currently administer programs that collect pesticide data in terms of mass of pesticide product applied. For that reason, pesticide application throughputs were derived from available information published by USDA. This data source reports county level crop acreage data; state-level pesticide active ingredient application rates by crop; and state-level fraction of crop-acres treated with a given active ingredient. The product of these parameters yields activity data in terms of mass of active ingredient by county and crop as shown in Equation III-1. Note this equation is fully incorporated in Equation II-1.

$$Activity\ Data \quad = \sum_{i,c,k}(I_{i,k} \times \ A_c \times T_{i,k}\ ) \qquad \text{(Eq. III-1)}$$

Where:

$Activity\ Data$ = mass of active ingredients in pounds
$I_{i,k}$ = pounds of active ingredient i applied per year per crop-acre in state k;
A_c = total crop-acres in county c;
$T_{i,k}$ = fraction of state crop-acres treated with active ingredient i

A. CROP ACREAGE

Crop acreage data were available from the USDA for the year 2011 (USDA, 2012b). The 2011 USDA survey covered a partial list of crops and did not provide information about non-row crops. Most commonly, crop acreage was expressed for annual crops in units of “acres planted” or “acres harvested”. For perennial, non-row crops, crop acreage was expressed as “acres bearing”.

Some information in the USDA surveys was withheld to prevent disclosing proprietary data. Estimates to allocate withheld data were developed in a two-step process, starting with estimating values for data withheld at the agricultural district-level and then at the state-level. First, agricultural district level withheld data were allocated to counties within that agricultural district. Second, the difference between state-level withheld data and district-level allocated data (step 1) was distributed to remaining counties without crop-acres data. Crop-acres per county as reported in the 2007 agricultural census was used as the surrogate for allocating withheld data (USDA, 2007).

Because annual crop acreage surveys are partial, it was necessary to combine several data sets to create a composite, more comprehensive data set. The composite data set drew from survey years 2011, 2010, 2008 and 2007. Priority was given to crop-acre data for the most recent survey year starting with 2011 and only supplemental data were drawn from previous survey years. The relative completeness of the crop coverage data set was evaluated by comparing the validation ration, calculated as the sum of crop-acres to the available number of cropland acres by county as reported in the 2007 Agricultural Census, illustrated in Figure III-1. The validation ratios are shown in Table III-2. Crop-acre data were deemed reasonably complete when the validation ratio fell between 0.8 and 1.2, assuming that a ±20% variation could be reasonably attributed to variance in land use and/or agricultural practices between data years. When contrasting Figures III-1 and III-2, it is apparent that the composite crop-acre data set is most complete in areas with highest agricultural intensity (e.g., Minnesota, Iowa) and less complete in areas with low agricultural intensity (e.g., southwest Texas). Tabulated crop-acre data are provided as Exhibit 1.

Figure III-1. Intensity of Agricultural Activity in Terms of Cropland Acres, 2007

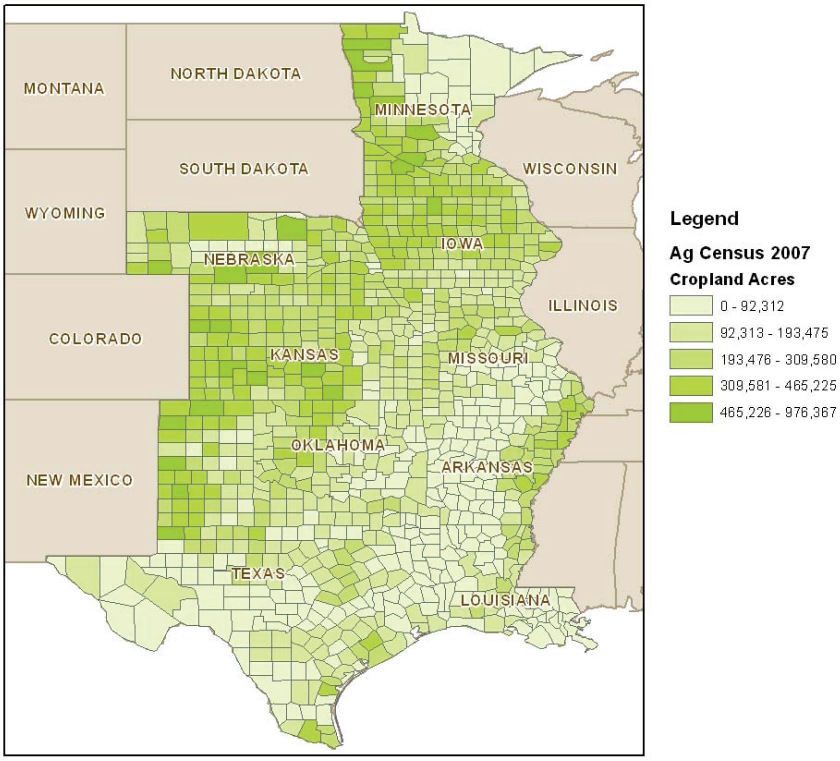
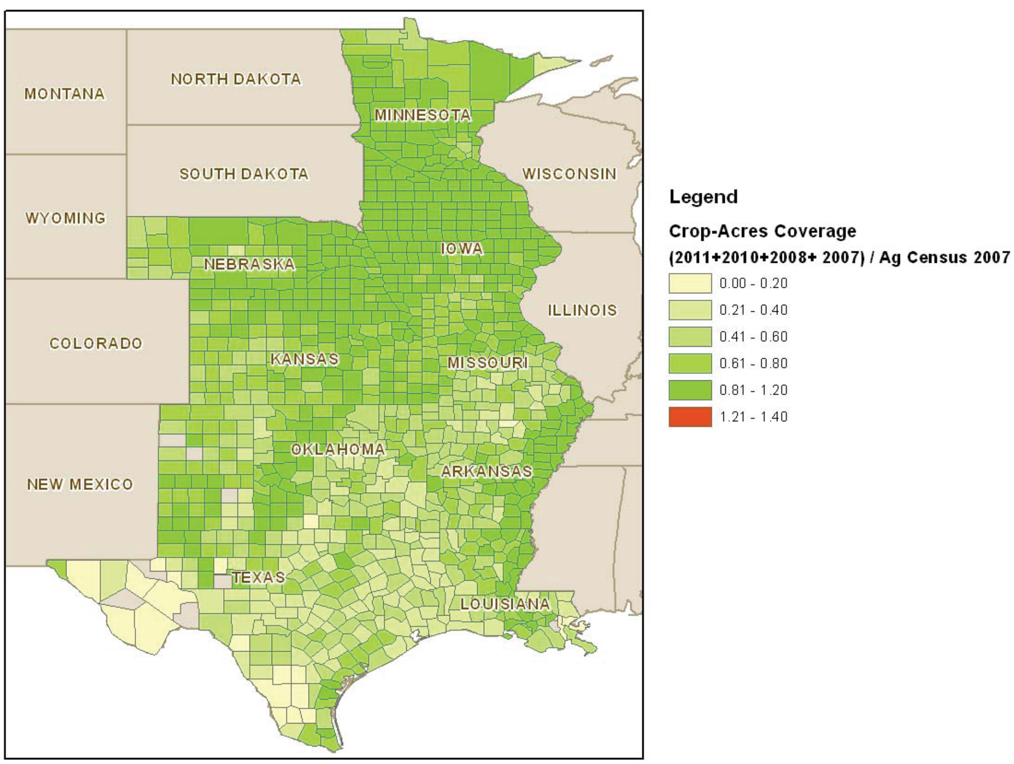


Figure III-2. Relative Crop-Acre Data Completion, 2011



B. PESTICIDE APPLICATION RATES

Pesticide application rates were available at the state-level from USDA (USDA, 2012a) and expressed in terms of pounds of active ingredient per crop-acre (see $I_{i,k}$ in Eq. III-1). From the same source, the fraction of crop-acres treated with each given active ingredient was compiled (see $T_{i,k}$ in Eq. III-1). Some active ingredient application data were withheld in the USDA database. In this instance, regional active ingredient application rates were used to fill in missing data points. For crops without state or regional pesticide application rates from USDA, application rates from the National Pesticide Use Database (NPUD) database maintained by the Crop Life Foundation were used (where available) (CLF, 2002). If NPUD data were not available for a particular state and crop, the average of all other states for that crop was used. In total, 2,448 crop and active ingredient combinations were developed. Some crops with marginal acreage had neither USDA nor NPUD active ingredient application rate data available. For this limited number of crops, emissions estimates were not developed because their impact to the inventory was deemed immaterial.

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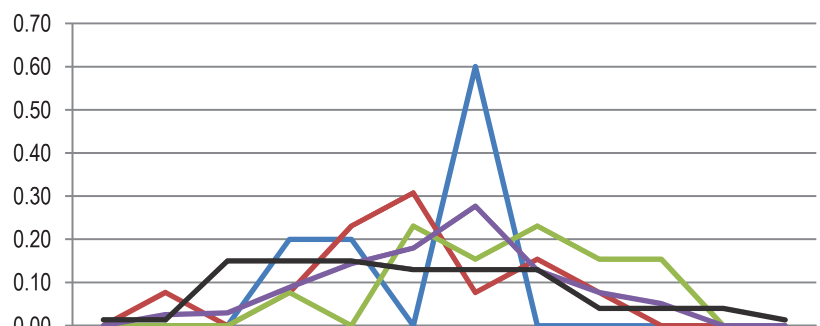
CHAPTER IV. MONTHLY ALLOCATION OF ANNUAL EMISSIONS

Pesticide applications follow seasonal patterns. In general most applications begin in the spring, intensify during the summer months and subside in the fall.

Relevant literature on monthly pesticide applications was scarce. In the case of Texas, one study tangentially addressed the temporal dimension of agricultural practices (Pechan, 2009). This study characterized the utilization of agricultural non-road equipment based on 2,309 survey responses. The input taken from the survey was the seasonal profile of spraying equipment. The utilization rates for sprayers were reported as 4 percent in the winter, 45 percent in spring, 39 percent in summer and 12 percent in fall.

For all other states, a survey was developed and administered to agriculture experts in each state. Participants were asked to report the frequency of pesticide application associated with twelve major row and five non-row crops by pesticide type (i.e., herbicide, insecticide, fungicide, other). A copy of the survey is provided as Exhibit-2. Unfortunately, survey participation was low (1 of 11), limited in its geography to the state of Kansas, and incomplete with regard to the number responses relative to the number of questions. For that reason, the temporal distribution factors were averaged over the entire crop sample by pesticide type. Note that for states without specific temporal allocation information, the same distribution factors as Kansas were applied. The temporal distribution curves and the values of the temporal distribution factors are summarized in Figure IV-1.

Figure IV-1. Temporal Distribution Curves and Values



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
KS: Fungicide	0.00	0.00	0.00	0.20	0.20	0.00	0.60	0.00	0.00	0.00	0.00	0.00
KS: Herbacide	0.00	0.08	0.00	0.08	0.23	0.31	0.08	0.15	0.08	0.00	0.00	0.00
KS: Insecticide	0.00	0.00	0.00	0.08	0.00	0.23	0.15	0.23	0.15	0.15	0.00	0.00
KS: Other	0.00	0.03	0.03	0.09	0.14	0.18	0.28	0.13	0.08	0.05	0.00	0.00
TX: All pesticide types	0.01	0.01	0.15	0.15	0.15	0.13	0.13	0.13	0.04	0.04	0.04	0.01

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CHAPTER V. RESULTS

The 2011 pesticide emissions inventory for the CenSARA region represents a significant improvement for estimating VOC and HAP emissions resulting from pesticide applications. The inventory is highly stratified so that planning studies can evaluate multiple aspects of pesticide applications at the county level. In general pesticide emissions increase almost linearly with the extent of treated crop-acres; however, operational practices such as the selection of pesticides, their chemical formulation, and rate of application (i.e., pounds of pesticide per crop-acre) can alter the general linear relationship. The interplay of operational factors helps create nuanced emission scenarios that reflect unique local agricultural practices as shown in Figure V-1; this figure illustrates the relative intensity of VOC and HAP emissions for all counties in the region and also underscores that fact that the relationship between HAP emissions VOC emissions is not always linear.

A key objective of the study was to identify the contribution of non-row crops (e.g., orchards) to pesticide application emissions. Given the overwhelming production of row-crops in the region as shown in Table V-1, it was found that the contribution of non-row crops to pesticide application emission is negligible. Actually, a handful of row-crops account for over 90% of state total pesticide application emissions (see Table V-2).

State level emissions are shown in Table V-3. Annual county-level summary results are included in this report as Appendices. Allocated crop-acre data for survey years 2011, 2010, 2008, 2007 and composite data set were prepared as Exhibit 1, accompanying this report in spreadsheet format. Finally, TranSystems developed the *CenSARA Pesticide Application Emission Tool* containing detailed emission results by county, crop, and pollutant. The *Emissions Tool* hosts the queries and reference tables (e.g., pesticide application rates, emission factors) supporting this analysis and can also be used for subsequent updates to the pesticide application emission inventories.

Table V-1. Comparison of Row-Crop and Non-Row Crop Acreage at the State-Level, EY2011

State	All crops	Row crops		Non-row crops	
	Acres	Acres	%	Acres	%
Arkansas	7,943,003	7,932,214	99.9%	10,789	0.1%
Iowa	24,874,849	24,873,265	100.0%	1,584	0.0%
Kansas	23,192,959	23,187,014	100.0%	5,945	0.0%
Louisiana	3,600,749	3,591,247	99.7%	9,502	0.3%
Minnesota	20,205,735	20,202,671	100.0%	3,064	0.0%
Missouri	14,115,948	14,099,650	99.9%	16,298	0.1%
Nebraska	19,437,313	19,436,702	100.0%	611	0.0%
Oklahoma	9,678,573	9,552,571	98.7%	126,002	1.3%
Texas	21,938,869	21,750,636	99.1%	188,233	0.9%
CenSARA region	144,987,998	144,625,970	99.8%	362,028	0.2%

Table V-2. Major Crops Emissions at the State-Level, EY2011

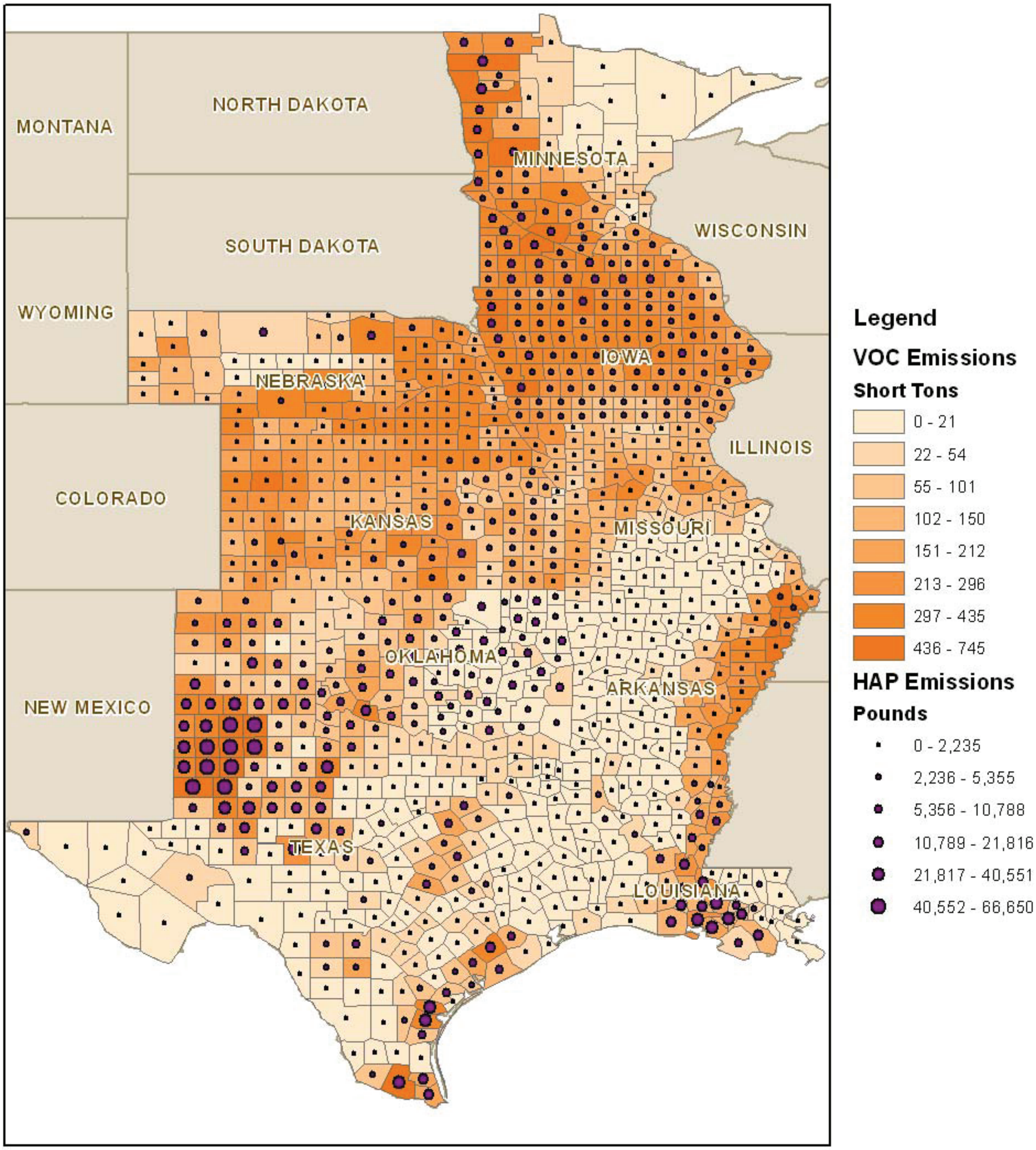
State	Crop	VOC (tons)	HAP (tons)	Total (tons)	Contribution to State Emissions
Arkansas	SOYBEANS	3,711.2		3,711.2	57.4%
Arkansas	COTTON, UPLAND	1,680.1	2.1	1,682.1	26.0%
Arkansas	RICE	675.3		675.3	10.4%
Arkansas	CORN	228.7	1.2	229.8	3.6%
Arkansas	WHEAT, WINTER	72.6	5.4	77.9	1.2%
Iowa	CORN	15,235.0	17.5	15,252.5	58.0%
Iowa	SOYBEANS	10,680.1	146.6	10,826.7	41.2%
Iowa	HAY	102.6	24.5	127.1	0.5%
Iowa	POTATOES	16.0	0.0	16.0	0.1%
Iowa	HAYLAGE	9.5	2.3	11.8	0.0%
Kansas	CORN	7,365.4	10.4	7,375.8	39.0%
Kansas	SOYBEANS	4,611.7		4,611.7	24.4%
Kansas	SORGHUM	3,702.2		3,702.2	19.6%
Kansas	WHEAT, WINTER	2,519.8		2,519.8	13.3%
Kansas	HAY	191.9	88.4	280.3	1.5%
Louisiana	SOYBEANS	1,468.1		1,468.1	31.8%
Louisiana	SUGARCANE, SUGAR	1,466.4	114.0	1,580.4	34.2%
Louisiana	COTTON, UPLAND	726.7	20.2	746.9	16.2%
Louisiana	CORN	236.8	1.2	238.1	5.2%
Louisiana	RICE	195.7		195.7	4.2%
Minnesota	CORN	8,170.9		8,170.9	43.5%
Minnesota	SOYBEANS	8,072.0	140.8	8,212.8	43.7%
Minnesota	WHEAT, SPRING, (EXCL DURUM)	798.2	2.1	800.4	4.3%
Minnesota	POTATOES	642.6	1.8	644.4	3.4%
Minnesota	SUGARBEETS	615.3	13.1	628.3	3.3%
Missouri	SOYBEANS	5,783.0		5,783.0	51.3%
Missouri	CORN	3,543.7		3,543.7	31.4%
Missouri	COTTON, UPLAND	1,045.3	7.0	1,052.2	9.3%
Missouri	WHEAT, WINTER	284.3		284.3	2.5%
Missouri	HAY	212.8	6.6	219.3	1.9%
Nebraska	CORN	11,388.5	12.2	11,400.7	60.9%
Nebraska	SOYBEANS	5,971.4	19.9	5,991.3	32.0%
Nebraska	POTATOES	494.4	0.8	495.2	2.6%
Nebraska	WHEAT, WINTER	378.9		378.9	2.0%
Nebraska	BEANS, DRY EDIBLE	130.1	0.7	130.8	0.7%
Oklahoma	WHEAT, WINTER	1,953.3	8.8	1,962.1	48.0%
Oklahoma	COTTON, UPLAND	886.2	28.4	914.6	22.4%
Oklahoma	HAY	421.2	136.1	557.3	13.6%
Oklahoma	SORGHUM	203.3		203.3	5.0%
Oklahoma	CORN	155.2	0.8	156.0	3.8%
Texas	COTTON, UPLAND	13,908.3	707.8	14,616.1	68.7%
Texas	CORN	2,504.7	2.5	2,507.2	11.8%
Texas	WHEAT, WINTER	1,515.9	24.0	1,539.9	7.2%
Texas	HAY	663.3	29.8	693.2	3.3%
Texas	SORGHUM	647.1		647.1	3.0%

Table V-3. Summary VOC and HAP Emissions at the State-Level, EY2011[2]

		Emissions			Intensity	
State	Cropland (acres)	VOC (tons)	HAP (tons)	Total (tons)	VOC/Cropland (lbs/acre)	HAP/Cropland (lbs/100-acre)
Arkansas	7,943,003	6,451.9	12.2	6,464.1	1.62	0.31
Iowa	24,874,849	26,088.8	192.4	26,281.2	2.10	1.55
Kansas	23,192,959	18,795.4	115.0	18,910.4	1.62	0.99
Louisiana	3,600,749	4,444.3	172.6	4,616.9	2.47	9.59
Minnesota	20,205,735	18,617.0	167.0	18,784.1	1.84	1.65
Missouri	14,115,948	11,258.6	19.9	11,278.5	1.60	0.28
Nebraska	19,437,313	18,656.4	63.6	18,720.1	1.92	0.65
Oklahoma	9,678,573	3,882.5	206.1	4,088.6	0.80	4.26
Texas	21,938,869	20,466.6	798.7	21,265.3	1.87	7.28
CenSARA Region	144,987,998	128,661.7	1,747.6	130,409.3	1.77	2.41

[2] The type of crop is an important factor to the emissions formula. This is represented by variables $I_{i,k}$; A_c ; $T_{i,k}$ in Equation II-1.

Figure V-1. EY2011 VOC and HAP Emissions Intensity at the County-Level, EY2011



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CHAPTER VI. UNCERTAINTIES AND ADDITIONAL DATA NEEDS

The recommended methodology assumes that the list of registered pesticide products in California is equivalent to that of the CenSARA states. Access to state specific pesticide databases would enable the project team to refine the VOC emission factor by state. However, CenSARA states do not currently maintain a product database with chemical formulation similar to that maintained by the California Department of Pesticide Regulation.

The temporal distribution of pesticide emissions was conducted on the basis of an elementary survey. Unfortunately, survey participation was low and the accuracy of the responses questionable. Adding to the uncertainty is the fact that pesticide applications are affected by environmental factors (e.g., strength of the pest, climate) and therefore the frequency and timing of pesticide applications are not consistent from year to year. Although there is high confidence in the annual emissions estimates produced by in this study, the temporal allocation of annual emissions results requires more refinement. In the future, the survey can be designed to be addressed to farmers directly and administered to a larger pool of participants to increase the confidence level survey responses.

Additionally, remote sensing and interpretation of satellite data may be used as an alternative or complementary approach to crop coverage characterization. Cropland characterization based on remote sensing can be useful in filling data gaps found in USDA agricultural surveys.[3]

[3] For more information about the use of remote sensing technology for cropland characterization contact Dr. Jessica L. McCarty at Michigan Tech Research Institute (MTRI), jmccarty@mtu.edu. Available geospatial information can be retrieved from http://nassgeodata.gmu.edu/CropScape/.

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CHAPTER VII. REFERENCES

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APPENDIX F. MISSOURI

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	001	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	31,389	0
Missouri	29	001	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	25	0
Missouri	29	001	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	001	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	225	0
Missouri	29	001	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	74,024	0
Missouri	29	001	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,616	186
Missouri	29	001	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,318	39
Missouri	29	001	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	546	0
Missouri	29	001	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,170	27
Missouri	29	001	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	001	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	22,789	37
Missouri	29	001	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	386	0
Missouri	29	001	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	142	0
Missouri	29	001	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	5,510	79
Missouri	29	003	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	122,978	0
Missouri	29	003	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	29	0
Missouri	29	003	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	254	0
Missouri	29	003	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	122,053	0
Missouri	29	003	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,365	65
Missouri	29	003	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	786	25
Missouri	29	003	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,141	0
Missouri	29	003	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,319	30
Missouri	29	003	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	25,693	42
Missouri	29	003	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	636	0
Missouri	29	003	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	116	0
Missouri	29	003	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,085	95
Missouri	29	005	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	296,809	0
Missouri	29	005	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	379	1
Missouri	29	005	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	261,133	0
Missouri	29	005	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	5,364	96
Missouri	29	005	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	587	5
Missouri	29	005	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	5,166	0
Missouri	29	005	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	38,295	62
Missouri	29	005	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,361	0
Missouri	29	005	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	205	0
Missouri	29	005	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,907	149
Missouri	29	007	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	209,475	0
Missouri	29	007	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	29	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	007	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	007	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	007	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	351,775	0
Missouri	29	007	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	13,954	105
Missouri	29	007	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	8,112	95
Missouri	29	007	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	3,646	0
Missouri	29	007	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,353	31
Missouri	29	007	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	7	1
Missouri	29	007	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	007	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,834	0
Missouri	29	007	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	965	0
Missouri	29	007	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	13,110	187
Missouri	29	009	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	14,307	0
Missouri	29	009	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	13	0
Missouri	29	009	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	009	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	229	0
Missouri	29	009	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	4,532	0
Missouri	29	009	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,874	167
Missouri	29	009	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,827	150
Missouri	29	009	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	249	0
Missouri	29	009	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	586	13
Missouri	29	009	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	009	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	23,122	38
Missouri	29	009	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	24	0
Missouri	29	009	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	133	0
Missouri	29	009	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,038	211
Missouri	29	011	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	127,265	0
Missouri	29	011	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	011	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	178,477	0
Missouri	29	011	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	36,704	245
Missouri	29	011	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	4,010	68
Missouri	29	011	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,215	0
Missouri	29	011	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	011	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	930	0
Missouri	29	011	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	2,646	0
Missouri	29	011	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	10,240	440
Missouri	29	013	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	127,327	0
Missouri	29	013	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	49	0
Missouri	29	013	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	013	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	434	1
Missouri	29	013	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	243,868	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	013	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	19,498	250
Missouri	29	013	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,652	79
Missouri	29	013	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,216	0
Missouri	29	013	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	2,252	52
Missouri	29	013	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	7	1
Missouri	29	013	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	43,855	71
Missouri	29	013	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,271	0
Missouri	29	013	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	1,050	0
Missouri	29	013	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	4,221	688
Missouri	29	015	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	30,108	0
Missouri	29	015	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	19	0
Missouri	29	015	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	015	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	166	0
Missouri	29	015	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	48,774	0
Missouri	29	015	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,979	157
Missouri	29	015	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	653	41
Missouri	29	015	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	524	0
Missouri	29	015	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	862	20
Missouri	29	015	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0
Missouri	29	015	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	16,779	27
Missouri	29	015	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	254	0
Missouri	29	015	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	174	0
Missouri	29	015	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,259	309
Missouri	29	017	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	19,431	0
Missouri	29	017	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	017	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	10,612	0
Missouri	29	017	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	9,945	150
Missouri	29	017	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	419	25
Missouri	29	017	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	338	0
Missouri	29	017	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	017	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	55	0
Missouri	29	017	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	462	0
Missouri	29	017	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	938	208
Missouri	29	019	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	47,618	0
Missouri	29	019	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	5	0
Missouri	29	019	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	1	0
Missouri	29	019	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	233	0
Missouri	29	019	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	98,626	0
Missouri	29	019	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	11,225	178
Missouri	29	019	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	2,761	52
Missouri	29	019	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	829	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	019	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	226	5
Missouri	29	019	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	15	2
Missouri	29	019	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	23,558	38
Missouri	29	019	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	514	0
Missouri	29	019	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	502	0
Missouri	29	019	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	8,182	366
Missouri	29	021	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	112,745	0
Missouri	29	021	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	22	0
Missouri	29	021	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	021	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	197	0
Missouri	29	021	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	118,697	0
Missouri	29	021	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,817	80
Missouri	29	021	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	546	7
Missouri	29	021	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,962	0
Missouri	29	021	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,023	23
Missouri	29	021	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0
Missouri	29	021	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	19,919	32
Missouri	29	021	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	619	0
Missouri	29	021	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	112	0
Missouri	29	021	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,888	378
Missouri	29	023	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	54,451	0
Missouri	29	023	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	1	0
Missouri	29	023	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	294	0
Missouri	29	023	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	279,477	0
Missouri	29	023	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	53,985	46
Missouri	29	023	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	9,308	102
Missouri	29	023	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	948	0
Missouri	29	023	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	45	1
Missouri	29	023	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	29,734	48
Missouri	29	023	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,457	0
Missouri	29	023	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	3,429	0
Missouri	29	023	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	18,948	494
Missouri	29	025	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	48,045	0
Missouri	29	025	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	24	0
Missouri	29	025	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	025	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	100,784	0
Missouri	29	025	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,740	127
Missouri	29	025	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	660	21
Missouri	29	025	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	836	0
Missouri	29	025	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,107	25
Missouri	29	025	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	025	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	525	0
Missouri	29	025	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	332	0
Missouri	29	025	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,480	91
Missouri	29	027	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	68,757	0
Missouri	29	027	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	8	0
Missouri	29	027	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	027	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	126,250	0
Missouri	29	027	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	11,982	163
Missouri	29	027	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,849	25
Missouri	29	027	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,197	0
Missouri	29	027	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	361	8
Missouri	29	027	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	027	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	658	0
Missouri	29	027	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	616	0
Missouri	29	027	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,600	406
Missouri	29	029	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	4,263	0
Missouri	29	029	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	2	0
Missouri	29	029	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	029	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	892	0
Missouri	29	029	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,080	87
Missouri	29	029	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	158	12
Missouri	29	029	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	74	0
Missouri	29	029	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	90	2
Missouri	29	029	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	029	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	5	0
Missouri	29	029	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	23	0
Missouri	29	029	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	178	7
Missouri	29	031	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	66,622	0
Missouri	29	031	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	29	0
Missouri	29	031	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	031	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	139,631	0
Missouri	29	031	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	18,521	134
Missouri	29	031	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	8,752	122
Missouri	29	031	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,160	0
Missouri	29	031	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,363	31
Missouri	29	031	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	031	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	728	0
Missouri	29	031	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	1,296	0
Missouri	29	031	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	14,643	89
Missouri	29	033	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	185,346	0
Missouri	29	033	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	445	1

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	033	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	262,212	0
Missouri	29	033	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	9,667	94
Missouri	29	033	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,186	15
Missouri	29	033	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	3,226	0
Missouri	29	033	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	45,043	73
Missouri	29	033	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,367	0
Missouri	29	033	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	605	0
Missouri	29	033	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	4,027	587
Missouri	29	035	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	402	0
Missouri	29	035	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	3	0
Missouri	29	035	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,650	0
Missouri	29	035	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	925	26
Missouri	29	035	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	18	0
Missouri	29	035	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	7	0
Missouri	29	035	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	150	3
Missouri	29	035	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	9	0
Missouri	29	035	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	8	0
Missouri	29	035	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	157	13
Missouri	29	037	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	75,377	0
Missouri	29	037	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	32	0
Missouri	29	037	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	037	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	281	0
Missouri	29	037	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	145,026	0
Missouri	29	037	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	9,553	151
Missouri	29	037	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	909	26
Missouri	29	037	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,312	0
Missouri	29	037	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,457	33
Missouri	29	037	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	1
Missouri	29	037	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	28,385	46
Missouri	29	037	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	756	0
Missouri	29	037	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	430	0
Missouri	29	037	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	4,216	517
Missouri	29	039	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	33,150	0
Missouri	29	039	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	11	0
Missouri	29	039	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	039	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	14,675	0
Missouri	29	039	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,998	142
Missouri	29	039	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	887	71
Missouri	29	039	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	577	0
Missouri	29	039	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	514	12
Missouri	29	039	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	039	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	77	0
Missouri	29	039	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	222	0
Missouri	29	039	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	666	11
Missouri	29	041	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	165,060	0
Missouri	29	041	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	40	0
Missouri	29	041	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	358	1
Missouri	29	041	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	262,212	0
Missouri	29	041	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	10,401	114
Missouri	29	041	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,059	11
Missouri	29	041	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,873	0
Missouri	29	041	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,859	43
Missouri	29	041	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	36,219	59
Missouri	29	041	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,367	0
Missouri	29	041	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	618	0
Missouri	29	041	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	3,778	575
Missouri	29	043	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,708	0
Missouri	29	043	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	8	0
Missouri	29	043	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	2,348	0
Missouri	29	043	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,013	175
Missouri	29	043	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	751	25
Missouri	29	043	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	30	0
Missouri	29	043	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	781	1
Missouri	29	043	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	12	0
Missouri	29	043	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	32	0
Missouri	29	043	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,896	19
Missouri	29	045	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	126,197	0
Missouri	29	045	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	29	0
Missouri	29	045	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	045	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	138,552	0
Missouri	29	045	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,782	109
Missouri	29	045	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	440	5
Missouri	29	045	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,197	0
Missouri	29	045	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,353	31
Missouri	29	045	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	0	0
Missouri	29	045	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	722	0
Missouri	29	045	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	301	0
Missouri	29	045	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,627	344
Missouri	29	047	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	28,613	0
Missouri	29	047	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	2	0
Missouri	29	047	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	047	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	047	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	50,716	0
Missouri	29	047	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,145	77
Missouri	29	047	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	256	2
Missouri	29	047	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	498	0
Missouri	29	047	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	90	2
Missouri	29	047	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	047	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	047	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	264	0
Missouri	29	047	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	58	0
Missouri	29	047	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,070	153
Missouri	29	049	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	87,121	0
Missouri	29	049	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	25	0
Missouri	29	049	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	049	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	101,000	0
Missouri	29	049	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,639	103
Missouri	29	049	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	525	6
Missouri	29	049	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,516	0
Missouri	29	049	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,141	26
Missouri	29	049	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	049	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	527	0
Missouri	29	049	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	120	0
Missouri	29	049	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,518	363
Missouri	29	051	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	11,104	0
Missouri	29	051	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	15	0
Missouri	29	051	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	051	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	133	0
Missouri	29	051	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	23,308	0
Missouri	29	051	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,268	145
Missouri	29	051	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,008	35
Missouri	29	051	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	193	0
Missouri	29	051	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	692	16
Missouri	29	051	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	051	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	13,469	22
Missouri	29	051	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	122	0
Missouri	29	051	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	144	0
Missouri	29	051	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	4,097	170
Missouri	29	053	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	110,823	0
Missouri	29	053	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	053	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	053	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	153,227	0
Missouri	29	053	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	14,650	139

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	053	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	487	23
Missouri	29	053	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,929	0
Missouri	29	053	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	1
Missouri	29	053	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	053	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	799	0
Missouri	29	053	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	934	0
Missouri	29	053	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,123	81
Missouri	29	055	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,643	0
Missouri	29	055	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	8	0
Missouri	29	055	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	055	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,295	0
Missouri	29	055	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	2,631	69
Missouri	29	055	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	293	11
Missouri	29	055	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	29	0
Missouri	29	055	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	353	8
Missouri	29	055	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	055	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	7	0
Missouri	29	055	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	37	0
Missouri	29	055	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	292	11
Missouri	29	057	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	29,467	0
Missouri	29	057	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	25	0
Missouri	29	057	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	221	0
Missouri	29	057	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	66,902	0
Missouri	29	057	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	19,583	140
Missouri	29	057	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	2,311	57
Missouri	29	057	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	513	0
Missouri	29	057	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,147	26
Missouri	29	057	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	22,348	36
Missouri	29	057	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	349	0
Missouri	29	057	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	1,388	0
Missouri	29	057	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	6,340	84
Missouri	29	059	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,708	0
Missouri	29	059	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	2	0
Missouri	29	059	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	059	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	6	0
Missouri	29	059	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	3,885	0
Missouri	29	059	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,434	180
Missouri	29	059	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,016	79
Missouri	29	059	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	30	0
Missouri	29	059	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	90	2
Missouri	29	059	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	059	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	585	1
Missouri	29	059	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	20	0
Missouri	29	059	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	54	0
Missouri	29	059	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,752	112
Missouri	29	061	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	81,356	0
Missouri	29	061	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	5	0
Missouri	29	061	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	061	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	162,507	0
Missouri	29	061	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,278	150
Missouri	29	061	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	492	9
Missouri	29	061	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,416	0
Missouri	29	061	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	226	5
Missouri	29	061	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	5	1
Missouri	29	061	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	847	0
Missouri	29	061	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	219	0
Missouri	29	061	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,089	124
Missouri	29	063	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	73,028	0
Missouri	29	063	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	26	0
Missouri	29	063	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	230	0
Missouri	29	063	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	106,396	0
Missouri	29	063	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,020	143
Missouri	29	063	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	358	3
Missouri	29	063	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,271	0
Missouri	29	063	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,197	27
Missouri	29	063	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	23,309	38
Missouri	29	063	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	555	0
Missouri	29	063	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	125	0
Missouri	29	063	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	702	71
Missouri	29	065	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,128	0
Missouri	29	065	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	1	0
Missouri	29	065	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	065	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	6	0
Missouri	29	065	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	4,634	0
Missouri	29	065	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	2,892	81
Missouri	29	065	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	129	9
Missouri	29	065	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	20	0
Missouri	29	065	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	45	1
Missouri	29	065	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	065	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	585	1
Missouri	29	065	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	24	0
Missouri	29	065	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	23	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	065	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	397	33
Missouri	29	067	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,783	0
Missouri	29	067	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	10	0
Missouri	29	067	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	067	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	067	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	7,323	0
Missouri	29	067	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,584	98
Missouri	29	067	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	240	18
Missouri	29	067	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	31	0
Missouri	29	067	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	462	11
Missouri	29	067	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	067	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	067	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	38	0
Missouri	29	067	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	36	0
Missouri	29	067	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	490	20
Missouri	29	069	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	45,570	0
Missouri	29	069	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	426	1
Missouri	29	069	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	223,366	0
Missouri	29	069	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	34,135	11
Missouri	29	069	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	492,420	5,088
Missouri	29	069	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	793	0
Missouri	29	069	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	43,067	70
Missouri	29	069	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,165	0
Missouri	29	069	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	2,628	0
Missouri	29	069	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	805,626	697
Missouri	29	071	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	44,415	0
Missouri	29	071	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	18	0
Missouri	29	071	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	1	0
Missouri	29	071	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	12	0
Missouri	29	071	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	60,212	0
Missouri	29	071	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	8,413	168
Missouri	29	071	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,928	52
Missouri	29	071	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	773	0
Missouri	29	071	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	811	19
Missouri	29	071	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	18	2
Missouri	29	071	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	1,171	2
Missouri	29	071	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	314	0
Missouri	29	071	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	275	0
Missouri	29	071	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	4,453	525
Missouri	29	073	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	13,025	0
Missouri	29	073	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	3	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	073	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	2	0
Missouri	29	073	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	073	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	24,818	0
Missouri	29	073	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	5,417	134
Missouri	29	073	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,027	25
Missouri	29	073	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	227	0
Missouri	29	073	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	135	3
Missouri	29	073	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	38	5
Missouri	29	073	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	073	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	129	0
Missouri	29	073	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	99	0
Missouri	29	073	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	704	14
Missouri	29	075	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	77,512	0
Missouri	29	075	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	30	0
Missouri	29	075	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	075	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	075	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	123,876	0
Missouri	29	075	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,188	93
Missouri	29	075	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,150	6
Missouri	29	075	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,349	0
Missouri	29	075	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,369	31
Missouri	29	075	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	075	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	075	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	646	0
Missouri	29	075	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	283	0
Missouri	29	075	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	7,334	83
Missouri	29	077	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	13,151	0
Missouri	29	077	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	25	0
Missouri	29	077	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	077	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	8	0
Missouri	29	077	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	7,553	0
Missouri	29	077	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	8,004	212
Missouri	29	077	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	665	45
Missouri	29	077	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	229	0
Missouri	29	077	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,156	27
Missouri	29	077	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	077	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	781	1
Missouri	29	077	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	39	0
Missouri	29	077	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	103	0
Missouri	29	077	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,462	94
Missouri	29	079	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	78,580	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	079	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	28	0
Missouri	29	079	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	079	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	131,214	0
Missouri	29	079	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,867	75
Missouri	29	079	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	424	4
Missouri	29	079	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,368	0
Missouri	29	079	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,278	29
Missouri	29	079	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	079	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	684	0
Missouri	29	079	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	219	0
Missouri	29	079	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	804	103
Missouri	29	081	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	103,990	0
Missouri	29	081	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	36	0
Missouri	29	081	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	155,601	0
Missouri	29	081	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,177	158
Missouri	29	081	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	503	5
Missouri	29	081	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,810	0
Missouri	29	081	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,683	39
Missouri	29	081	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	811	0
Missouri	29	081	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	187	0
Missouri	29	081	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	275	8
Missouri	29	083	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	57,227	0
Missouri	29	083	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	2	0
Missouri	29	083	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	083	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	133,372	0
Missouri	29	083	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	14,164	165
Missouri	29	083	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	2,969	247
Missouri	29	083	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	996	0
Missouri	29	083	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	90	2
Missouri	29	083	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	5	1
Missouri	29	083	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	695	0
Missouri	29	083	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	811	0
Missouri	29	083	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	3,299	517
Missouri	29	085	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	6,174	0
Missouri	29	085	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	13	0
Missouri	29	085	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	6,259	0
Missouri	29	085	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,979	112
Missouri	29	085	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,030	59
Missouri	29	085	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	107	0
Missouri	29	085	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	613	14
Missouri	29	085	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	33	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	085	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	32	0
Missouri	29	085	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	3,161	18
Missouri	29	087	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	219,938	0
Missouri	29	087	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	33	0
Missouri	29	087	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	297	0
Missouri	29	087	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	192,289	0
Missouri	29	087	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	2,064	28
Missouri	29	087	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	469	5
Missouri	29	087	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	3,828	0
Missouri	29	087	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,540	35
Missouri	29	087	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	29,987	49
Missouri	29	087	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,003	0
Missouri	29	087	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	103	0
Missouri	29	087	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,071	51
Missouri	29	089	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	74,950	0
Missouri	29	089	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	26	0
Missouri	29	089	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	233	0
Missouri	29	089	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	94,742	0
Missouri	29	089	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	8,012	122
Missouri	29	089	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	751	37
Missouri	29	089	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,305	0
Missouri	29	089	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,210	28
Missouri	29	089	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	23,562	38
Missouri	29	089	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	494	0
Missouri	29	089	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	374	0
Missouri	29	089	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,999	295
Missouri	29	091	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	2,288	0
Missouri	29	091	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	6	0
Missouri	29	091	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	091	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	214	0
Missouri	29	091	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	9,397	0
Missouri	29	091	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	5,987	167
Missouri	29	091	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	764	56
Missouri	29	091	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	40	0
Missouri	29	091	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	271	6
Missouri	29	091	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0
Missouri	29	091	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	21,655	35
Missouri	29	091	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	49	0
Missouri	29	091	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	52	0
Missouri	29	091	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,425	271
Missouri	29	093	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	522	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	093	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	2,144	0
Missouri	29	093	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	1,418	40
Missouri	29	093	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	67	5
Missouri	29	093	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	9	0
Missouri	29	093	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	11	0
Missouri	29	093	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	11	0
Missouri	29	095	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	55,091	0
Missouri	29	095	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	16	0
Missouri	29	095	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	095	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	141	0
Missouri	29	095	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	69,492	0
Missouri	29	095	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	5,478	63
Missouri	29	095	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	388	7
Missouri	29	095	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	959	0
Missouri	29	095	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	730	17
Missouri	29	095	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	095	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	14,228	23
Missouri	29	095	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	362	0
Missouri	29	095	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	318	0
Missouri	29	095	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,951	253
Missouri	29	097	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	60,857	0
Missouri	29	097	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	6	0
Missouri	29	097	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	097	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	230	0
Missouri	29	097	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	110,280	0
Missouri	29	097	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	24,967	137
Missouri	29	097	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,104	52
Missouri	29	097	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,059	0
Missouri	29	097	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	271	6
Missouri	29	097	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	097	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	23,250	38
Missouri	29	097	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	575	0
Missouri	29	097	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	1,887	0
Missouri	29	097	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,545	340
Missouri	29	099	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	9,182	0
Missouri	29	099	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	9	0
Missouri	29	099	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	099	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	8	0
Missouri	29	099	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	13,596	0
Missouri	29	099	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,079	76
Missouri	29	099	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	261	4

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	099	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	160	0
Missouri	29	099	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	437	10
Missouri	29	099	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	6	1
Missouri	29	099	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	781	1
Missouri	29	099	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	71	0
Missouri	29	099	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	62	1
Missouri	29	099	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,429	187
Missouri	29	101	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	87,121	0
Missouri	29	101	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	17	0
Missouri	29	101	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	101	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	101	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	158,838	0
Missouri	29	101	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	16,882	328
Missouri	29	101	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,648	122
Missouri	29	101	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,516	0
Missouri	29	101	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	766	18
Missouri	29	101	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	6	1
Missouri	29	101	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	101	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	828	0
Missouri	29	101	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	573	0
Missouri	29	101	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,629	186
Missouri	29	103	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	106,571	0
Missouri	29	103	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	33	0
Missouri	29	103	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	103	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	292	0
Missouri	29	103	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	151,069	0
Missouri	29	103	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,153	82
Missouri	29	103	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	535	7
Missouri	29	103	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,855	0
Missouri	29	103	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,519	35
Missouri	29	103	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	5	1
Missouri	29	103	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	29,581	48
Missouri	29	103	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	788	0
Missouri	29	103	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	321	0
Missouri	29	103	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	3,095	404
Missouri	29	105	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	5,338	0
Missouri	29	105	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	2	0
Missouri	29	105	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	105	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	4,316	0
Missouri	29	105	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	5,906	162
Missouri	29	105	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	279	12

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	105	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	93	0
Missouri	29	105	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	90	2
Missouri	29	105	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	105	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	23	0
Missouri	29	105	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	60	0
Missouri	29	105	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,256	119
Missouri	29	107	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	208,834	0
Missouri	29	107	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	44	0
Missouri	29	107	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	107	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	6	0
Missouri	29	107	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	239,552	0
Missouri	29	107	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,139	95
Missouri	29	107	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,065	21
Missouri	29	107	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	3,635	0
Missouri	29	107	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	2,029	47
Missouri	29	107	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	1
Missouri	29	107	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	585	1
Missouri	29	107	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,249	0
Missouri	29	107	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	374	0
Missouri	29	107	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	4,899	714
Missouri	29	109	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	18,777	0
Missouri	29	109	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	30	0
Missouri	29	109	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	109	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	109	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	25,034	0
Missouri	29	109	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	12,886	232
Missouri	29	109	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,951	70
Missouri	29	109	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	327	0
Missouri	29	109	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,387	32
Missouri	29	109	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	1
Missouri	29	109	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	109	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	131	0
Missouri	29	109	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	494	0
Missouri	29	109	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	8,319	134
Missouri	29	111	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	134,311	0
Missouri	29	111	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	31	0
Missouri	29	111	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	111	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	145,889	0
Missouri	29	111	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,106	81
Missouri	29	111	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	499	5
Missouri	29	111	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,338	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	111	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,417	33
Missouri	29	111	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	111	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	761	0
Missouri	29	111	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	412	0
Missouri	29	111	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,442	404
Missouri	29	113	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	93,527	0
Missouri	29	113	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	8	0
Missouri	29	113	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	113	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	230	0
Missouri	29	113	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	146,321	0
Missouri	29	113	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	10,463	88
Missouri	29	113	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,426	42
Missouri	29	113	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,628	0
Missouri	29	113	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	361	8
Missouri	29	113	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	113	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	23,231	38
Missouri	29	113	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	763	0
Missouri	29	113	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	702	0
Missouri	29	113	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	350	14
Missouri	29	115	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	60,002	0
Missouri	29	115	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	37	0
Missouri	29	115	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	154,090	0
Missouri	29	115	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	9,924	177
Missouri	29	115	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	998	52
Missouri	29	115	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,044	0
Missouri	29	115	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,703	39
Missouri	29	115	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	803	0
Missouri	29	115	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	380	0
Missouri	29	115	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,752	123
Missouri	29	117	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	76,658	0
Missouri	29	117	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	34	0
Missouri	29	117	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	117	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	303	0
Missouri	29	117	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	220,129	0
Missouri	29	117	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,805	61
Missouri	29	117	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	872	11
Missouri	29	117	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,334	0
Missouri	29	117	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,572	36
Missouri	29	117	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	5	1
Missouri	29	117	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	30,605	50
Missouri	29	117	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,148	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	117	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	444	0
Missouri	29	117	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	3,231	500
Missouri	29	119	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	6,838	0
Missouri	29	119	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	7	0
Missouri	29	119	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	119	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	119	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,695	0
Missouri	29	119	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,782	109
Missouri	29	119	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	228	9
Missouri	29	119	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	119	0
Missouri	29	119	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	316	7
Missouri	29	119	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	119	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	119	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	9	0
Missouri	29	119	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	23	0
Missouri	29	119	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	630	44
Missouri	29	121	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	71,965	0
Missouri	29	121	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	121	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	165,572	0
Missouri	29	121	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	12,514	274
Missouri	29	121	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,009	50
Missouri	29	121	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,253	0
Missouri	29	121	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	121	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	863	0
Missouri	29	121	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	335	0
Missouri	29	121	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,287	110
Missouri	29	123	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	772	0
Missouri	29	123	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	123	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,511	0
Missouri	29	123	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	2,087	59
Missouri	29	123	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	111	9
Missouri	29	123	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	13	0
Missouri	29	123	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	123	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	8	0
Missouri	29	123	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	16	0
Missouri	29	123	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	0	0
Missouri	29	125	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	5,552	0
Missouri	29	125	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	16	0
Missouri	29	125	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	7,338	0
Missouri	29	125	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,655	123
Missouri	29	125	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	426	23

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	125	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	97	0
Missouri	29	125	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	754	17
Missouri	29	125	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	38	0
Missouri	29	125	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	60	0
Missouri	29	125	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,291	241
Missouri	29	127	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	121,927	0
Missouri	29	127	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	26	0
Missouri	29	127	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	127	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	125,603	0
Missouri	29	127	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,997	67
Missouri	29	127	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	584	37
Missouri	29	127	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,122	0
Missouri	29	127	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,221	28
Missouri	29	127	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	127	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	655	0
Missouri	29	127	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	444	0
Missouri	29	127	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	616	8
Missouri	29	129	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	36,727	0
Missouri	29	129	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	79,807	0
Missouri	29	129	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,893	119
Missouri	29	129	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	301	3
Missouri	29	129	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	639	0
Missouri	29	129	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	416	0
Missouri	29	129	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	94	0
Missouri	29	129	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	408	6
Missouri	29	131	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	2,776	0
Missouri	29	131	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	131	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	8	0
Missouri	29	131	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	10,359	0
Missouri	29	131	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,060	154
Missouri	29	131	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	898	74
Missouri	29	131	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	48	0
Missouri	29	131	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	131	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	781	1
Missouri	29	131	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	54	0
Missouri	29	131	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	97	0
Missouri	29	131	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	554	22
Missouri	29	133	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	80,715	0
Missouri	29	133	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	369	1
Missouri	29	133	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	372,277	0
Missouri	29	133	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	40,336	9

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	133	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	10,407	109
Missouri	29	133	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,405	0
Missouri	29	133	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	37,268	61
Missouri	29	133	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,941	0
Missouri	29	133	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	3,669	0
Missouri	29	133	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	16,027	14
Missouri	29	135	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	14,378	0
Missouri	29	135	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	23	0
Missouri	29	135	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	135	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	135	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	48,558	0
Missouri	29	135	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	10,360	206
Missouri	29	135	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	538	34
Missouri	29	135	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	250	0
Missouri	29	135	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,072	25
Missouri	29	135	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0
Missouri	29	135	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	135	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	253	0
Missouri	29	135	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	341	0
Missouri	29	135	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,856	136
Missouri	29	137	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	130,254	0
Missouri	29	137	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	137	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	334	1
Missouri	29	137	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	180,204	0
Missouri	29	137	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	9,499	118
Missouri	29	137	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	2,606	62
Missouri	29	137	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,267	0
Missouri	29	137	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	5	1
Missouri	29	137	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	33,747	55
Missouri	29	137	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	940	0
Missouri	29	137	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	520	0
Missouri	29	137	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	525	90
Missouri	29	139	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	101,428	0
Missouri	29	139	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	26	0
Missouri	29	139	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	158,838	0
Missouri	29	139	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	10,792	73
Missouri	29	139	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,434	40
Missouri	29	139	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,765	0
Missouri	29	139	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,189	27
Missouri	29	139	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	828	0
Missouri	29	139	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	777	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	139	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,923	310
Missouri	29	141	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	14,947	0
Missouri	29	141	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	141	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	15	0
Missouri	29	141	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	23,308	0
Missouri	29	141	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,824	169
Missouri	29	141	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,663	99
Missouri	29	141	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	260	0
Missouri	29	141	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0
Missouri	29	141	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	1,562	3
Missouri	29	141	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	122	0
Missouri	29	141	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	128	0
Missouri	29	141	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	5,487	185
Missouri	29	143	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	131,536	0
Missouri	29	143	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	418,677	0
Missouri	29	143	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	35,189	13
Missouri	29	143	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	355,671	3,611
Missouri	29	143	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,289	0
Missouri	29	143	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	2,183	0
Missouri	29	143	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	2,751	0
Missouri	29	143	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	555,603	13
Missouri	29	145	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	13,449	0
Missouri	29	145	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	23	0
Missouri	29	145	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	205	0
Missouri	29	145	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	12,086	0
Missouri	29	145	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	10,614	218
Missouri	29	145	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,077	56
Missouri	29	145	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	234	0
Missouri	29	145	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,063	24
Missouri	29	145	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	20,712	34
Missouri	29	145	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	63	0
Missouri	29	145	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	326	0
Missouri	29	145	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,364	276
Missouri	29	147	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	273,321	0
Missouri	29	147	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	3	0
Missouri	29	147	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	19	0
Missouri	29	147	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	298,900	0
Missouri	29	147	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	9,654	217
Missouri	29	147	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	2,994	53
Missouri	29	147	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	4,757	0
Missouri	29	147	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	135	3

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	147	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	1,952	3
Missouri	29	147	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,558	0
Missouri	29	147	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	238	0
Missouri	29	147	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	13,856	186
Missouri	29	149	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,268	0
Missouri	29	149	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	7	0
Missouri	29	149	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	149	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	63	0
Missouri	29	149	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	5,209	0
Missouri	29	149	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,134	88
Missouri	29	149	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	149	10
Missouri	29	149	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	22	0
Missouri	29	149	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	328	8
Missouri	29	149	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	149	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	6,393	10
Missouri	29	149	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	27	0
Missouri	29	149	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	26	0
Missouri	29	149	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	462	30
Missouri	29	151	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	21,353	0
Missouri	29	151	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	22	0
Missouri	29	151	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	6	0
Missouri	29	151	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	27,840	0
Missouri	29	151	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,950	169
Missouri	29	151	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,436	58
Missouri	29	151	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	372	0
Missouri	29	151	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,001	23
Missouri	29	151	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	585	1
Missouri	29	151	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	145	0
Missouri	29	151	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	135	0
Missouri	29	151	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	269	49
Missouri	29	153	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,520	0
Missouri	29	153	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	14	0
Missouri	29	153	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	153	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	121	0
Missouri	29	153	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	6,242	0
Missouri	29	153	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,485	97
Missouri	29	153	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	227	17
Missouri	29	153	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	26	0
Missouri	29	153	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	628	14
Missouri	29	153	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	153	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	12,239	20

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	153	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	33	0
Missouri	29	153	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	31	0
Missouri	29	153	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	427	3
Missouri	29	155	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	43,686	0
Missouri	29	155	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	336,668	0
Missouri	29	155	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	42,591	10
Missouri	29	155	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	231,042	2,345
Missouri	29	155	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	760	0
Missouri	29	155	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,755	0
Missouri	29	155	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	3,133	0
Missouri	29	155	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	360,351	53
Missouri	29	157	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	53,810	0
Missouri	29	157	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	20	0
Missouri	29	157	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	157	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	6	0
Missouri	29	157	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	93,231	0
Missouri	29	157	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	12,096	92
Missouri	29	157	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,116	52
Missouri	29	157	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	937	0
Missouri	29	157	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	946	22
Missouri	29	157	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	7	1
Missouri	29	157	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	585	1
Missouri	29	157	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	486	0
Missouri	29	157	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	840	0
Missouri	29	157	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,739	306
Missouri	29	159	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	125,557	0
Missouri	29	159	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	43	0
Missouri	29	159	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	381	1
Missouri	29	159	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	199,842	0
Missouri	29	159	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	17,124	215
Missouri	29	159	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	2,120	105
Missouri	29	159	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,185	0
Missouri	29	159	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,977	45
Missouri	29	159	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	38,502	63
Missouri	29	159	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,042	0
Missouri	29	159	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	927	0
Missouri	29	159	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	781	32
Missouri	29	161	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	6,049	0
Missouri	29	161	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	8	0
Missouri	29	161	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	161	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	71	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	161	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,266	0
Missouri	29	161	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	2,995	81
Missouri	29	161	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	174	10
Missouri	29	161	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	105	0
Missouri	29	161	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	367	8
Missouri	29	161	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	161	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	7,142	12
Missouri	29	161	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	7	0
Missouri	29	161	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	33	0
Missouri	29	161	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	277	12
Missouri	29	163	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	127,051	0
Missouri	29	163	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	19	0
Missouri	29	163	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	163	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	169,629	0
Missouri	29	163	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	11,647	141
Missouri	29	163	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,193	52
Missouri	29	163	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,211	0
Missouri	29	163	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	857	20
Missouri	29	163	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	5	1
Missouri	29	163	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	884	0
Missouri	29	163	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	649	0
Missouri	29	163	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,899	123
Missouri	29	165	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	92,689	0
Missouri	29	165	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	22	0
Missouri	29	165	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	165	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	6	0
Missouri	29	165	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	105,964	0
Missouri	29	165	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,646	84
Missouri	29	165	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	617	6
Missouri	29	165	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,613	0
Missouri	29	165	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,030	24
Missouri	29	165	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	165	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	585	1
Missouri	29	165	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	552	0
Missouri	29	165	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	84	0
Missouri	29	165	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,287	325
Missouri	29	167	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	8,328	0
Missouri	29	167	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	11	0
Missouri	29	167	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	167	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	17	0
Missouri	29	167	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	13,165	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	167	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	10,635	297
Missouri	29	167	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	616	43
Missouri	29	167	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	145	0
Missouri	29	167	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	496	11
Missouri	29	167	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	0	0
Missouri	29	167	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	1,756	3
Missouri	29	167	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	69	0
Missouri	29	167	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	92	0
Missouri	29	167	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,687	133
Missouri	29	169	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	3,942	0
Missouri	29	169	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	10	0
Missouri	29	169	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	169	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,511	0
Missouri	29	169	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	2,420	67
Missouri	29	169	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	370	33
Missouri	29	169	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	69	0
Missouri	29	169	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	446	10
Missouri	29	169	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	0	0
Missouri	29	169	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	8	0
Missouri	29	169	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	21	0
Missouri	29	169	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	387	15
Missouri	29	171	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	32,457	0
Missouri	29	171	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	22	0
Missouri	29	171	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	59,348	0
Missouri	29	171	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	5,835	145
Missouri	29	171	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	297	2
Missouri	29	171	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	565	0
Missouri	29	171	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,011	23
Missouri	29	171	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	309	0
Missouri	29	171	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	101	0
Missouri	29	171	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	194	4
Missouri	29	173	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	109,115	0
Missouri	29	173	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	28	0
Missouri	29	173	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	252	0
Missouri	29	173	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	147,832	0
Missouri	29	173	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,410	67
Missouri	29	173	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	604	37
Missouri	29	173	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,899	0
Missouri	29	173	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,309	30
Missouri	29	173	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	25,493	41
Missouri	29	173	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	771	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	173	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	483	0
Missouri	29	173	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,193	70
Missouri	29	175	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	39,285	0
Missouri	29	175	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	23	0
Missouri	29	175	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	175	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	96,037	0
Missouri	29	175	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	8,211	131
Missouri	29	175	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	536	8
Missouri	29	175	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	684	0
Missouri	29	175	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,075	25
Missouri	29	175	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	3	0
Missouri	29	175	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	501	0
Missouri	29	175	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	361	0
Missouri	29	175	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,447	320
Missouri	29	177	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	93,313	0
Missouri	29	177	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	32	0
Missouri	29	177	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	177	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	287	0
Missouri	29	177	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	147,400	0
Missouri	29	177	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,049	170
Missouri	29	177	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	723	12
Missouri	29	177	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,624	0
Missouri	29	177	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,492	34
Missouri	29	177	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	5	1
Missouri	29	177	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	29,051	47
Missouri	29	177	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	768	0
Missouri	29	177	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	140	0
Missouri	29	177	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,813	438
Missouri	29	179	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	685	0
Missouri	29	179	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	6	0
Missouri	29	179	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	51	0
Missouri	29	179	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	2,812	0
Missouri	29	179	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	1,472	41
Missouri	29	179	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	31	0
Missouri	29	179	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	12	0
Missouri	29	179	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	265	6
Missouri	29	179	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	5,166	8
Missouri	29	179	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	15	0
Missouri	29	179	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	14	0
Missouri	29	179	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	273	8
Missouri	29	181	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,307	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	181	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	181	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	29,782	0
Missouri	29	181	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,159	55
Missouri	29	181	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	160	12
Missouri	29	181	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	23	0
Missouri	29	181	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0
Missouri	29	181	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	155	0
Missouri	29	181	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	139	0
Missouri	29	181	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	173	1
Missouri	29	183	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	90,110	0
Missouri	29	183	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	16	0
Missouri	29	183	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	1	0
Missouri	29	183	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	217	0
Missouri	29	183	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	108,338	0
Missouri	29	183	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,740	28
Missouri	29	183	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	830	14
Missouri	29	183	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,568	0
Missouri	29	183	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	721	17
Missouri	29	183	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	26	3
Missouri	29	183	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	21,926	36
Missouri	29	183	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	565	0
Missouri	29	183	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	354	0
Missouri	29	183	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,760	400
Missouri	29	185	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	31,603	0
Missouri	29	185	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	25	0
Missouri	29	185	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	185	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	72,945	0
Missouri	29	185	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	12,015	136
Missouri	29	185	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	3,208	251
Missouri	29	185	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	550	0
Missouri	29	185	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,166	27
Missouri	29	185	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	185	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	380	0
Missouri	29	185	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	696	0
Missouri	29	185	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,536	381
Missouri	29	186	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	21,994	0
Missouri	29	186	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	14	0
Missouri	29	186	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	186	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	121	0
Missouri	29	186	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	32,588	0
Missouri	29	186	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,042	126

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	186	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	916	52
Missouri	29	186	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	383	0
Missouri	29	186	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	631	14
Missouri	29	186	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	186	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	12,280	20
Missouri	29	186	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	170	0
Missouri	29	186	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	273	0
Missouri	29	186	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,135	164
Missouri	29	187	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,473	0
Missouri	29	187	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	10	0
Missouri	29	187	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	1	0
Missouri	29	187	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	187	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	4,964	0
Missouri	29	187	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,773	99
Missouri	29	187	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	234	6
Missouri	29	187	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	26	0
Missouri	29	187	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	453	10
Missouri	29	187	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	12	1
Missouri	29	187	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	187	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	26	0
Missouri	29	187	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	52	0
Missouri	29	187	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	622	51
Missouri	29	189	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	8,114	0
Missouri	29	189	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	3	0
Missouri	29	189	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	189	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	28	0
Missouri	29	189	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	15,323	0
Missouri	29	189	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	1,274	5
Missouri	29	189	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	129	5
Missouri	29	189	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	141	0
Missouri	29	189	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	144	3
Missouri	29	189	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	0	0
Missouri	29	189	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	2,802	5
Missouri	29	189	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	80	0
Missouri	29	189	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	103	0
Missouri	29	189	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,812	181
Missouri	29	195	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	292,538	0
Missouri	29	195	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	494	1
Missouri	29	195	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	308,612	0
Missouri	29	195	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,136	81
Missouri	29	195	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,306	47

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	195	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	5,092	0
Missouri	29	195	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	50,006	81
Missouri	29	195	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,609	0
Missouri	29	195	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	322	0
Missouri	29	195	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,234	43
Missouri	29	197	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	24,129	0
Missouri	29	197	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	17	0
Missouri	29	197	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	44,457	0
Missouri	29	197	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,345	79
Missouri	29	197	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	206	1
Missouri	29	197	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	420	0
Missouri	29	197	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	801	18
Missouri	29	197	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	232	0
Missouri	29	197	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	70	0
Missouri	29	197	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	104	3
Missouri	29	199	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	92,868	0
Missouri	29	199	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	25	0
Missouri	29	199	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	224	0
Missouri	29	199	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	131,645	0
Missouri	29	199	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,900	105
Missouri	29	199	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	249	3
Missouri	29	199	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,616	0
Missouri	29	199	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,162	27
Missouri	29	199	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	22,641	37
Missouri	29	199	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	686	0
Missouri	29	199	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	133	0
Missouri	29	199	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	893	84
Missouri	29	201	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	139,223	0
Missouri	29	201	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	31	0
Missouri	29	201	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	201	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	278	0
Missouri	29	201	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	198,116	0
Missouri	29	201	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	32,265	20
Missouri	29	201	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	9,831	124
Missouri	29	201	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,423	0
Missouri	29	201	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,443	33
Missouri	29	201	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	1
Missouri	29	201	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	28,106	46
Missouri	29	201	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,033	0
Missouri	29	201	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	2,900	0
Missouri	29	201	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	22,395	719

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	203	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	772	0
Missouri	29	203	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	3,172	0
Missouri	29	203	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	1,841	51
Missouri	29	203	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	25	0
Missouri	29	203	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	13	0
Missouri	29	203	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	17	0
Missouri	29	203	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	16	0
Missouri	29	205	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	112,745	0
Missouri	29	205	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	35	0
Missouri	29	205	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	214,518	0
Missouri	29	205	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	9,011	86
Missouri	29	205	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	701	46
Missouri	29	205	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	1,962	0
Missouri	29	205	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,635	38
Missouri	29	205	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	1,118	0
Missouri	29	205	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	571	0
Missouri	29	205	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	624	5
Missouri	29	207	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	172,747	0
Missouri	29	207	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	64	0
Missouri	29	207	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	207	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	573	1
Missouri	29	207	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	401,411	0
Missouri	29	207	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	57,148	17
Missouri	29	207	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	270,751	2,761
Missouri	29	207	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	3,007	0
Missouri	29	207	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	2,973	68
Missouri	29	207	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	9	1
Missouri	29	207	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	57,906	94
Missouri	29	207	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	2,093	0
Missouri	29	207	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	4,253	0
Missouri	29	207	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	425,084	201
Missouri	29	209	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	4,584	0
Missouri	29	209	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	2	0
Missouri	29	209	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	209	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	63	0
Missouri	29	209	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,136	0
Missouri	29	209	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	2,578	74
Missouri	29	209	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	140	6
Missouri	29	209	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	80	0
Missouri	29	209	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	90	2
Missouri	29	209	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	1	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	209	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	6,341	10
Missouri	29	209	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	6	0
Missouri	29	209	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	16	0
Missouri	29	209	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	974	87
Missouri	29	211	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	29,040	0
Missouri	29	211	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	288	0
Missouri	29	211	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	65,175	0
Missouri	29	211	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,744	202
Missouri	29	211	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	435	4
Missouri	29	211	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	505	0
Missouri	29	211	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	29,172	47
Missouri	29	211	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	340	0
Missouri	29	211	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	109	0
Missouri	29	211	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,564	102
Missouri	29	213	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	577	0
Missouri	29	213	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	1	0
Missouri	29	213	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	213	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	29	0
Missouri	29	213	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	2,368	0
Missouri	29	213	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	992	27
Missouri	29	213	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	215	20
Missouri	29	213	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	10	0
Missouri	29	213	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	45	1
Missouri	29	213	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	0	0
Missouri	29	213	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	2,907	5
Missouri	29	213	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	12	0
Missouri	29	213	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	12	0
Missouri	29	213	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	275	14
Missouri	29	215	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	2,673	0
Missouri	29	215	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	15	0
Missouri	29	215	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	133	0
Missouri	29	215	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	10,978	0
Missouri	29	215	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	6,412	179
Missouri	29	215	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	864	71
Missouri	29	215	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	47	0
Missouri	29	215	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	692	16
Missouri	29	215	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	13,475	22
Missouri	29	215	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	57	0
Missouri	29	215	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	55	0
Missouri	29	215	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,169	71
Missouri	29	217	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	122,880	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	217	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	42	0
Missouri	29	217	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	217	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	376	1
Missouri	29	217	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	167,471	0
Missouri	29	217	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	14,781	180
Missouri	29	217	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	1,945	124
Missouri	29	217	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	2,139	0
Missouri	29	217	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,951	45
Missouri	29	217	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	0	0
Missouri	29	217	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	37,996	62
Missouri	29	217	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	873	0
Missouri	29	217	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	822	0
Missouri	29	217	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	3,992	585
Missouri	29	219	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	40,357	0
Missouri	29	219	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	13	0
Missouri	29	219	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	219	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	2	0
Missouri	29	219	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	64,528	0
Missouri	29	219	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	4,350	52
Missouri	29	219	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	578	5
Missouri	29	219	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	702	0
Missouri	29	219	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	623	14
Missouri	29	219	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	219	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	194	0
Missouri	29	219	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	336	0
Missouri	29	219	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	245	0
Missouri	29	219	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	2,260	248
Missouri	29	221	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	1,368	0
Missouri	29	221	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	8	0
Missouri	29	221	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	75	0
Missouri	29	221	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,079	0
Missouri	29	221	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	3,345	93
Missouri	29	221	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	269	12
Missouri	29	221	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	24	0
Missouri	29	221	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	391	9
Missouri	29	221	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	7,610	12
Missouri	29	221	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	6	0
Missouri	29	221	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	31	0
Missouri	29	221	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	153	6
Missouri	29	223	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	802	0
Missouri	29	223	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	6	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	223	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	51	0
Missouri	29	223	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	6,474	0
Missouri	29	223	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	1,649	45
Missouri	29	223	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	245	4
Missouri	29	223	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	14	0
Missouri	29	223	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	265	6
Missouri	29	223	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	5,156	8
Missouri	29	223	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	34	0
Missouri	29	223	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	16	0
Missouri	29	223	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,417	9
Missouri	29	225	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	6,406	0
Missouri	29	225	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	27	0
Missouri	29	225	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	225	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	4	0
Missouri	29	225	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	1,942	0
Missouri	29	225	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	8,241	232
Missouri	29	225	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	604	50
Missouri	29	225	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	112	0
Missouri	29	225	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,233	28
Missouri	29	225	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	4	0
Missouri	29	225	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	390	1
Missouri	29	225	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	10	0
Missouri	29	225	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	58	0
Missouri	29	225	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	1,024	103
Missouri	29	227	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	28,827	0
Missouri	29	227	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	13	0
Missouri	29	227	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	0	0
Missouri	29	227	2461850004	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Potatoes	112	0
Missouri	29	227	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	59,014	0
Missouri	29	227	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	1,705	31
Missouri	29	227	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	356	12
Missouri	29	227	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	502	0
Missouri	29	227	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	584	13
Missouri	29	227	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	2	0
Missouri	29	227	2461850054	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Potatoes	11,370	19
Missouri	29	227	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	308	0
Missouri	29	227	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	64	0
Missouri	29	227	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	756	61
Missouri	29	229	2461850001	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Corn	2,505	0
Missouri	29	229	2461850002	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Apples	23	0
Missouri	29	229	2461850003	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Grapes	1	0

State	State FIPS	County FIPS	SCC	SCC Description	VOC (lbs)	HAP (lbs)
Missouri	29	229	2461850005	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Soy Beans	10,289	0
Missouri	29	229	2461850006	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Hay & Grains	7,828	224
Missouri	29	229	2461850009	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Herbicides, Not Elsewhere Classified	245	14
Missouri	29	229	2461850051	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Corn	44	0
Missouri	29	229	2461850052	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Apples	1,068	25
Missouri	29	229	2461850053	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Grapes	31	4
Missouri	29	229	2461850055	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Soy Beans	54	0
Missouri	29	229	2461850056	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Hay & Grains	51	0
Missouri	29	229	2461850099	Misc Non-industrial: Commercial /Pesticide Application: Agricultural /Other Pesticides, Not Elsewhere Classified	941	65

APENDIX J. AVERAGE VOC EMISSIONS FACTORS

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
100301	METHIDATHION	0.830
100601	FENAMIPHOS	0.810
101101	METRIBUZIN	0.034
101103	PYMETROZINE	0.020
101201	METHAMIDOPHOS	0.740
101701	PRONAMIDE	0.057
101702	ZOXAMIDE	0.014
102001	THIOPHANATE METHYL	0.360
102001	THIOPHANATE-METHYL	0.360
103001	NAPROPAMIDE	0.820
103301	ACEPHATE	0.260
103601	GLYPHOSATE ISO. SALT	1.800
103604	GLYPHOSATE AMM. SALT	0.041
103613	GLYPHOSATE POT. SALT	0.110
103801	OXAMYL	1.100
103901	BENTAZON	0.000
104201	ORYZALIN	1.200
104601	FENBUTATIN OXIDE	0.056
104601	FENBUTATIN-OXIDE	0.056
104801	DESMEDIPHAM	2.400
10501	DICOFOL	0.079
105801	NORFLURAZON	0.270
106902	ASULAM	0.200
107091	ETOXAZOLE	0.380

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
107201	HEXAZINONE	0.220
108201	DIFLUBENZURON	0.120
108501	PENDIMETHALIN	1.500
108800	S-METOLACHLOR	0.250
108801	METOLACHLOR	0.130
109101	MEPIQUAT CHLORIDE	2.300
109303	ESFENVALERATE	9.000
109701	PERMETHRIN	5.700
109801	IPRODIONE	0.470
109901	TRIADIMEFON	0.086
110003	SPINOSAD	2.000
110008	SPINETORAM	0.200
110008	SPINETORAM-J	0.200
110601	ETHOFUMESATE	1.400
110902	DICLOFOP-METHYL	1.200
111601	OXYFLUORFEN	1.400
113101	ETHALFLURALIN	1.700
113202	FAMOXADONE	0.074
113501	METALAXYL	1.100
113502	MEFENOXAM	0.760
114402	ACIFLUORFEN, SODIUM	1.900
114501	THIODICARB	0.130
116901	BENZYLADENINE	18.000
117401	CLOPYRALID MONO SALT	0.110

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
117403	CLOPYRALID	0.012
118203	SAFLUFENACIL	0.015
118601	CHLORSULFURON	0.036
118831	BETA-CYFLUTHRIN	0.970
119009	TRIFLOXYSULFURON-SOD	0.014
119302	PROPAMOCARB HYDROCH.	0.200
120051	DIMETHENAMID-P	0.740
120301	THIDIAZURON	0.130
120603	TETRACONAZOLE	0.490
121000	TRALKOXYDIM	0.140
121001	SETHOXYDIM	4.000
121011	CLETHODIM	2.300
121027	METHOXYFENOZIDE	0.210
121301	CYROMAZINE	0.650
121701	AZADIRACHTIN	6.700
122009	MESOSULFURON-METHYL	0.820
122010	METSULFURON-METHYL	0.043
122101	PROPICONAZOLE	1.800
122806	EMAMECTIN BENZOATE	6.200
122809	FLUAZIFOP	11.000
122809	FLUAZIFOP-P-BUTYL	11.000
12301	BROMACIL	0.510
123301	FOSETYL-AL	0.044
124002	NOVALURON	3.100
124871	SPIRODICLOFEN	0.260
125401	CLOMAZONE	0.690

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
125501	CLOFENTEZINE	0.130
125619	METCONAZOLE	1.700
12701	TERBACIL	0.023
127901	FENPROPATHRIN	1.600
128008	BOSCALID	0.057
128016	FLONICAMID	0.059
128501	SULFOSATE	0.450
128701	FENOXAPROP	3.100
128711	QUIZALOFOP	4.100
128711	QUIZALOFOP-ETHYL	4.100
128712	CARFENTRAZONE-ETHYL	0.720
128721	HALOSULFURON	0.089
128724	FLUMICLORAC-PENTYL	0.570
128725	METHYL ANTHRANILATE	1.900
128807	GAMMA-CYHALOTHRIN	2.700
128810	AZOXYSTROBIN	0.470
128820	BENSULFURON-METHYL	0.030
128825	BIFENTHRIN	1.500
128831	CYFLUTHRIN	1.600
128845	THIFENSULFURON	0.049
128847	DIFENOCONAZOLE	1.100
128849	HEXYTHIAZOX	1.300
128850	GLUFOSINATE-AMMONIUM	0.700
128857	MYCLOBUTANIL	1.400
128879	TRIFLUMIZOLE	0.140
128887	TRIBENURON-METHYL	0.021

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
128897	LAMBDACYHALOTHRIN	1.600
128897	LAMBDA-CYHALOTHRIN	1.600
128906	Z-8-DODECEN ACETATE	2.500
128907	E-8-DODECENYL ACETAT	2.500
128908	Z-8-DODECANOL	2.500
128920	BROMOXYNIL HEPTAN.	0.390
128922	IMAZETHAPYR	0.020
128923	IMAZETHAPYR, AMMON.	0.920
128931	DICAMBA, DIGLY. SALT	0.065
128943	IMAZAPIC-AMMONIUM	4.100
128959	FLUROXYPYR	0.280
128961	MONOCARBAMIDE DIHYD.	0.060
128968	FLUROXYPYR 1-MHE	0.480
128974	QUINCLORAC	0.990
128975	FLUTOLANIL	0.093
128997	TEBUCONAZOLE	0.880
129008	NICOSULFURON	0.041
129009	RIMSULFURON	0.067
129011	FENBUCONAZOLE	0.170
129016	FLUMETSULAM	0.070
129026	TEBUFENOZIDE	0.140
129028	DODECADIEN-1-OL	2.300
129032	PYRIPROXYFEN	12.000
129034	FLUMIOXAZIN	0.073
129041	IMAZAPIC	0.016
129064	Z-CYPERMETHRIN	1.100

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
129064	ZETA-CYPERMETHRIN	1.100
129081	SULFENTRAZONE	0.930
129092	FENOXAPROP-P-ETHYL	4.500
129098	FLUAZINAM	0.550
129099	IMIDACLOPRID	0.960
129105	PYRIDABEN	0.038
129106	CYMOXANIL	0.097
129111	KRESOXIM-METHYL	0.020
129112	TRIFLOXYSTROBIN	0.130
129121	FIPRONIL	0.580
129131	FENPYROXIMATE	3.900
129171	IMAZAMOX	0.016
13803	MSMA	0.180
14002	CYANAMID	0.100
14019	THIACLOPRID	0.120
14504	MANCOZEB	0.091
14505	MANEB	0.100
14601	METIRAM	0.072
147500	PINOXADEN	7.800
1509	DODECANOL	0.520
1510	TETRADECANOL	0.580
19202	MCPB	1.200
206600	FENARIMOL	2.300
22501	COPPER	0.670
22702	COPPER AMM. COMPLEX	0.051
23104	COPPER RESINATE	0.630

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
23401	COPPER HYDROXIDE	0.074
23503	COPPER OXYCHLO. SUL.	0.044
24401	COPPER SULFATE	0.320
24875	SPIROMESIFEN	0.130
25007	NEEM OIL, CLAR. HYD.	1.900
25601	COPPER OXIDE	0.270
26201	CYCLANILIDE	0.100
268800	DIMETHOMORPH	0.066
27401	DICHLOBENIL	1.200
27412	FLUOPICOLIDE	0.099
275100	BUPROFEZIN	0.340
27602	FLUBENDIAMIDE	0.150
28201	PROPANIL	0.072
288201	PYRIMETHANIL	0.180
288202	CYPRODINIL	0.019
29001	DICHLOROPROPENE	1.000
29801	DICAMBA	1.700
29802	DICAMBA, DIMET. SALT	0.460
29806	DICAMBA, SODIUM SALT	0.015
30016	2,4-D, DIETH. SALT	0.470
30019	2,4-D, DIMETH. SALT	0.630
30063	2,4-D, 2-EHE	0.710
30066	2,4-D, ISOPROP ESTER	0.400
30090	PYRAFLUFEN-ETHYL	1.600
30501	MCPA	0.280
30516	MCPA, DIMETHYL. SALT	0.530

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
30563	MCPA, ISOOCTYL ESTER	0.082
30564	MCPA, 2-ETHYLHEXYL	0.870
30703	NAPTALAM	0.310
30819	2,4-DB, DIMETH. SALT	0.610
31301	DICLORAN	0.021
32201	DIQUAT DIBROMIDE	2.000
32501	DISULFOTON	1.100
34401	NALED	0.430
34801	FERBAM	0.060
34805	ZIRAM	0.012
34903	IRON PHOSPHATE	4.400
35001	DIMETHOATE	1.100
35201	DICROTOPHOS	0.240
35302	BROMOXYNIL OCTANOATE	0.840
35503	FLUOMETURON	0.061
35505	DIURON	0.260
35506	LINURON	0.081
36602	MANDIPROPAMIDE TECHN	0.094
39002	METAM-POTASSIUM	0.380
39003	METAM-SODIUM	0.540
392201	SPIROTETRAMAT	0.200
41101	ETHOPROP	0.300
41301	CYCLOATE	1.300
41401	EPTC	0.360
41402	MOLINATE	0.950
41403	PEBULATE	0.870

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
417300	GLYPHOSATE	0.300
43801	GIBBERELLIC ACID	13.000
44301	DODINE	0.088
44309	CLOTHIANIDIN	0.440
46679	FENAMIDONE	0.100
5107	DIFLUFENZOPYR-SODIUM	0.015
51503	MALEIC HYDRAZIDE	0.066
53001	METALDEHYDE	1.200
53501	METHYL PARATHION	0.150
55459	QUINOLINE	0.130
55809	REYNOUTRIA SACHALINE	0.820
56001	NAD	0.340
56002	NAA	11.000
56003	NAA, POTASSIUM SALT	0.520
56004	NAA, AMMONIUM SALT	0.000
56007	NAA, SODIUM	2.600
57201	PHORATE	0.190
57801	DIAZINON	0.390
58001	AZINPHOS-METHYL	0.037
586	BIFENAZATE	0.170
58702	OXYDEMETON-METHYL	0.000
59201	PHOSMET	3.300
595	HYDROGEN PEROXIDE	0.670
60109	THIAMETHOXAM	0.200
61601	PARAQUAT	0.130
6306	STREPTOMYCIN	0.150

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
6310	STREPTOMYCIN SULFATE	0.087
63501	PETROLEUM OIL	0.280
63502	MINERAL OIL	0.160
63502	OIL	0.160
6438	PSEUDO. FLUORES A506	0.024
67501	PIPERONYL BUTOXIDE	9.400
67701	DIPHACINONE	0.016
67710	INDOXACARB	0.610
69001	PYRETHRINS	13.000
71503	FLUDIOXONIL	0.130
73301	SODIUM CHLORATE	0.000
73508	POTASSIUM BICARBON.	0.017
74801	TRIBUFOS	0.410
76702	CALCIUM POLYSULFIDE	0.092
77501	SULFUR	0.140
78001	SULFURIC ACID	0.320
78701	DCPA	0.062
78802	TRIALLATE	0.610
78905	PYRITHIOBAC-SODIUM	0.450
78906	BISPYRIBAC-SODIUM	0.120
79401	ENDOSULFAN	1.200
79801	THIRAM	0.160
8001	COPPER OXYCHLORIDE	0.023
80803	ATRAZINE	0.530
80805	PROMETRYN	0.091
80807	SIMAZINE	0.086

PC Code	Active Ingredient	EF (lbs VOC/lbs Active Ingredient)
8101	BASIC COPPER SULFATE	0.016
81501	CHLOROPICRIN	1.000
81901	CHLOROTHALONIL	0.130
82583	CYHALOFOP-BUTYL	0.350
83601	TRIPHENYLTIN HYDROX.	0.039
84301	BENEFIN	1.200
85601	SULFOSULFURON	0.027
85651	CYAZOFAMID	0.170
86802	XYLENE	0.150
88601	ZINC PHOSPHIDE	1.900
90100	CHLORANTRANILIPROLE	0.360
90209	FENHEXAMID	0.037
90301	METHOMYL	0.640
90501	ALACHLOR	0.530
90601	CARBOFURAN	0.240
97301	FORMETANATE HYDRO.	0.013
97601	PROPARGITE	0.120
97805	DELTAMETHRIN	5.000
9801	BENSULIDE	0.490
98301	ALDICARB	0.063
98701	PHENMEDIPHAM	2.800
99050	ACETAMIPRID	0.170
99100	PYRACLOSTROBIN	0.590
99101	BENOMYL	0.470
99801	ETHEPHON	0.810

Appendix B-3

CenSARA Fuel Combustion Tool

CenSARA Area Combustion Emissions Inventory Enhancement Project

Final Report

Contract No. 12-0103-MSO-058

Prepared for:

Theresa Pella
Central States Air Resource Agencies (CenSARA)
P.O. Box 617
Oklahoma City, OK 73101

Prepared by:

Darcy Wilson, Marty Wolf, Stacie Enoch, and Bebhinn Do
Eastern Research Group, Inc.
1600 Perimeter Park Drive, Suite 200
Morrisville, NC 27560

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Figure 1. Map of the Nine-State CenSARA Area 2

***Disclaimer**: The data in this final report and accompanying tool should be considered preliminary and under review by the states. For final 2011 NEI data, please contact the individual state.*

1.0 INTRODUCTION

State agencies must prepare and submit emissions inventories to the U.S. Environmental Protection Agency (EPA) as part of the national emissions inventory (NEI). Industrial, commercial/institutional, and residential fuel combustion are important contributors to area source emissions of criteria pollutants and hazardous air pollutants (HAPs). The goal of this project was to compile base year 2011 industrial, commercial/institutional (ICI), and residential fuel combustion activity data at the county level for each CenSARA state; develop a crosswalk between area and point source Source Classification Codes (SCCs) to facilitate point source adjustments; review and improve the available emission factors and calculation methods as needed; and provide support for point source adjustments.

The geographic coverage of the CenSARA area consists of the states of Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, Oklahoma, and Texas (Figure 1).

The air pollutants addressed in this project include criteria pollutants, HAPs, and a particulate matter (PM) precursor as follows:

- Criteria pollutants – Carbon monoxide (CO), nitrogen oxides (NO_x), directly emitted PM less than 10 micrometers (μm) in aerodynamic diameter and less than 2.5 μm in aerodynamic diameter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOC);
- HAPs – HAPs emitted from fuel combustion for which emissions factors are available, particularly several polycyclic organic matter (POM) species, metals (e.g., mercury, chromium, etc.), and dioxins/furans; and
- PM precursor – ammonia (NH_3).

Where necessary, the HAP metals were speciated to correspond with valid NEI pollutant codes.

This project covers emissions from fuel combustion at stationary area sources within the ICI and residential sectors. Fuel combustion emissions were estimated for the following fuel types:

- Coal,
- Distillate oil,
- Residual oil,
- Natural gas,
- Liquefied petroleum gas (LPG),
- Kerosene, and
- Wood (excluding residential).

Table 1 displays the area source SCCs associated with ICI and residential fuel combustion. There are additional types of materials that are consumed in the industrial sector, however, the additional fossil fuels are not actually combusted (oxidized) but are used as chemical feedstocks, construction materials, lubricants, solvents, or reducing agents. Therefore, there are no industrial sector combustion emissions from these fuel types.

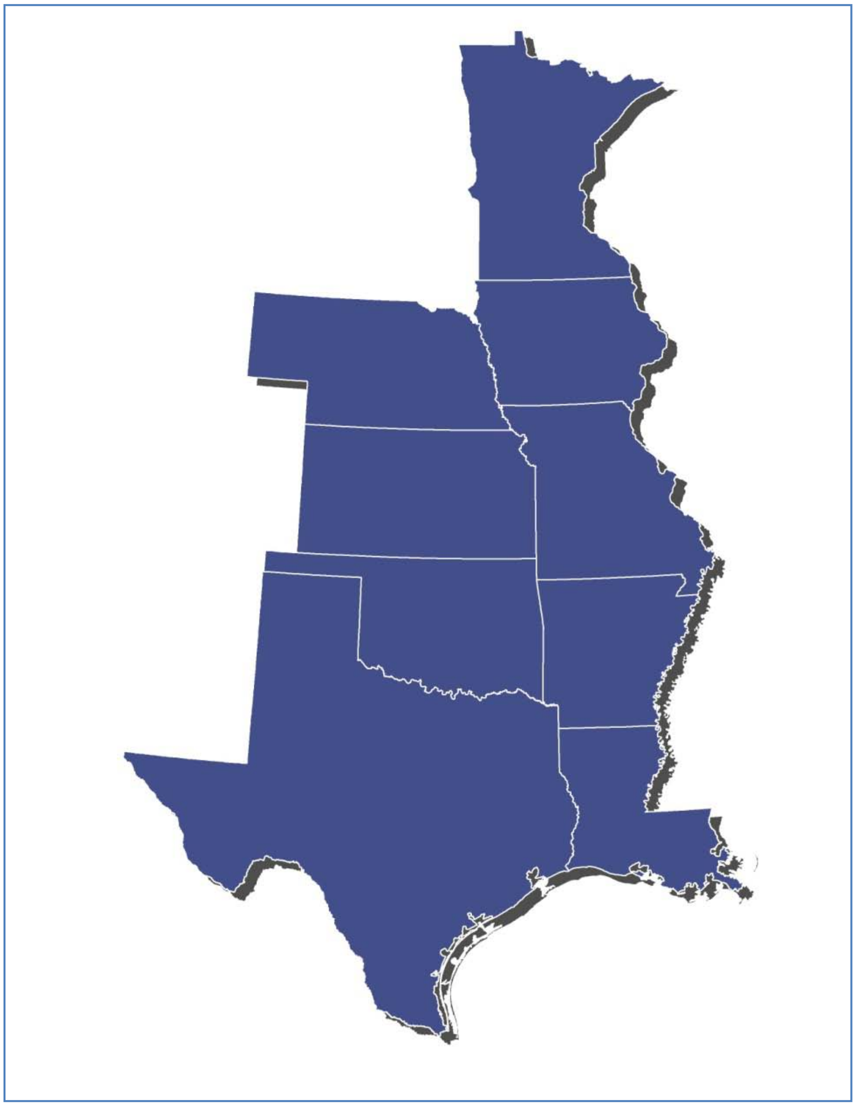

Figure 1. Map of the Nine-State CenSARA Area

Table 1. Area Source Fuel Combustion SCCs

SCC	Description
Industrial Fuel Combustion	
2102001000	Industrial Fuel Combustion; Anthracite Coal; Total: All Boiler Types
2102002000	Industrial Fuel Combustion; Bituminous/Subbituminous Coal; Total: All Boiler Types
2102004000	Industrial Fuel Combustion; Distillate Oil; Total: Boilers and IC Engines
2102004001	Industrial Fuel Combustion; Distillate Oil; Total: Boilers
2102004002	Industrial Fuel Combustion; Distillate Oil; Total: IC Engines
2102005000	Industrial Fuel Combustion; Residual Oil; Total: All Boiler Types
2102006000	Industrial Fuel Combustion; Industrial; Natural Gas; Total: Boilers and IC Engines
2102007000	Industrial Fuel Combustion; Liquid Petroleum Gas; Total: All Boiler Types
2102008000	Industrial Fuel Combustion; Wood; Total: All Boiler Types
2102011000	Industrial Fuel Combustion; Kerosene; Total: All Boiler Types
Commercial/Institutional Fuel Combustion	
2103001000	Commercial/Institutional Fuel Combustion; Anthracite Coal; Total: All Boiler Types
2103002000	Commercial/Institutional Fuel Combustion; Bituminous/Subbituminous Coal; Total: All Boiler Types
2103004000	Commercial/Institutional Fuel Combustion; Distillate Oil; Total: Boilers and IC Engines
2103004001	Commercial/Institutional Fuel Combustion; Distillate Oil; Total: Boilers
2103004002	Commercial/Institutional Fuel Combustion; Distillate Oil; Total: IC Engines
2103005000	Commercial/Institutional Fuel Combustion; Residual Oil; Total: All Boiler Types
2103006000	Commercial/Institutional Fuel Combustion; Natural Gas; Total: Boilers and IC Engines
2103007000	Commercial/Institutional Fuel Combustion; Liquid Petroleum Gas; Total: All Combustor Types
2103008000	Commercial/Institutional Fuel Combustion; Wood; Total: All Boiler Types
2103011000	Commercial/Institutional Fuel Combustion; Kerosene; Total: All Combustor Types
Residential Fuel Combustion	
2104001000	Residential Fuel Combustion; Anthracite Coal; Total: All Combustor Types
2104002000	Residential Fuel Combustion; Bituminous/Subbituminous Coal; Total: All Combustor Types
2104004000	Residential Fuel Combustion; Distillate Oil; Total: All Combustor Types
2104005000	Residential Fuel Combustion; Residual Oil; Total: All Combustor Types
2104006000	Residential Fuel Combustion; Natural Gas; Total: All Combustor Types
2104007000	Residential Fuel Combustion; Liquefied Petroleum Gas (LPG); Total: All Combustor Types
2104011000	Residential Fuel Combustion; Kerosene; Total: All Heater Types

2.0 CROSSWALK BETWEEN AREA AND POINT SOURCE SCCs

To avoid double counting between point and area sources, an accurate SCC crosswalk between area source SCCs and point source SCCs is needed. Double counting can occur when a facility is inventoried as a point source, but its fuel usage is also included as a part of the area source fuel usage estimates. If correctly assigned, point source SCCs specifically identify the combustor type, sector, and fuel type. The crosswalk must accurately map area source SCCs to point source SCCs so that the point source adjustments are made correctly. Tables A-1 and A-2 of

Appendix A present the ICI point and area source SCC crosswalks. The area sources are listed as subheadings in each table. Below each subheading is a list of point sources that map to the area source. There are typically no combustion point sources in the residential sector.

3.0 COMPILATION OF ICI AND RESIDENTIAL ACTIVITY DATA

The starting point for this project was the base year 2010 fuel consumption data available from the Energy Information Administration's State Energy Data System (SEDS) (EIA, 2012a; EIA, 2012b). [Base year 2011 data were not available.] The SEDS provides total state-level energy consumption estimates by state, sector, and fuel type.

The general approach used to calculate emissions for ICI and residential fuel combustion was to first compile state-level fuel consumption estimates, make adjustments to the EIA/SEDS data for mobile source fuel usage and non-combustion fuel usage, make the necessary point source adjustments, allocate the area source estimates to the county-level, and then multiply the fuel consumption estimates by appropriate emission factors.

Table 2 summarizes the area source activity data and units. It should be noted that physical unit SEDS data (i.e., tons, barrels, or cubic feet) were used for coal, residual oil, natural gas, LPG, and kerosene combustion, while Btu SEDS data were used for industrial and commercial and wood combustion.

Table 2. Nonpoint Source ICI and Residential Fuel Combustion Activity Data

Fuel and Combustor Type	Activity
Anthracite Coal; Total: All Boiler Types[a]	Thousand short tons of coal consumed
Bituminous/Subbituminous Coal; Total: All Boiler Types[a]	Thousand short tons of coal consumed
Distillate Oil; Total: Boilers	Thousand barrels of distillate oil consumed
Distillate Oil; Total: IC Engines	Thousand barrels of distillate oil consumed
Residual Oil; Total: All Boiler Types	Thousand barrels of residual oil consumed
Natural Gas; Total: Boilers and IC Engines	Million cubic feet of natural gas consumed
LPG; Total: All Boiler Types	Thousand barrels of LPG consumed
Wood; Total: All Boiler Types	Billion Btu of wood consumed
Kerosene; Total: All Boiler Types	Thousand barrels of kerosene consumed

[a] Residential coal reported in short tons of coal consumed.

3.1 Fuel-Specific Activity Data Adjustments

Coal – For coal combustion, it is necessary to compile data representing a subset of total sector coal consumption. Data representing non-coke plant consumption were compiled from EIA because coal consumed by coke plants is accounted for in the point source inventory. The SEDS data do not provide coal consumption estimates by type of coal (i.e., anthracite versus bituminous/subbituminous). Therefore, state-level ICI coal distribution data for 2010 from the EIA's *Annual Coal Distribution Report 2010* were used to allocate coal consumption between the two types of coal (EIA, 2011). The 2010 ratio of anthracite coal consumption to total coal consumption was used for this allocation procedure.

For the residential sector, 2006 state-level residential coal distribution data from the EIA's *Domestic Distribution of U.S. Coal by Destination State, Consumer, Origin and Method of Transportation* were used to allocate coal consumption between the two types of coal (EIA, 2008). [The 2006 version of this document was used because subsequent versions do not have residential anthracite and bituminous/subbituminous fractions.]

Table 3 presents the 2010 anthracite and bituminous/subbituminous coal ratios for each CenSARA state.

Table 3. Proportion of 2010 ICI and Residential Coal Consumption by Type of Coal

State	% Industrial Bituminous/ Subbituminous[a]	% Commercial/ Institutional Bituminous/ Subbituminous[a]	% Residential Anthracite	% Residential Bituminous/ Subbituminous
Arkansas	100.0	100.0	18.6	81.4
Iowa	N/A [b]	N/A	0.1	99.9
Kansas	N/A	N/A	0.0	0.0
Louisiana	100.0	100.0	0.0	100.0
Minnesota	99.8	100.0	0.3	99.7
Missouri	100.0	100.0	0.0	100.0
Nebraska	100.0	100.0	0.0	100.0
Oklahoma	100.0	100.0	8.3	91.7
Texas	100.0	100.0	18.6	81.4

[a] Anthracite ICI coal use was only reported for Minnesota (0.2%).

[b] N/A = Not applicable.

Distillate Oil and LPG – The SEDS ICI distillate oil and LPG consumption data include consumption estimates for equipment that are typically included in the nonroad sector inventory. In particular, SEDS considers the following nonroad source category activities to be part of the industrial sector: farming, logging, mining, and construction.

In order to avoid double-counting of distillate oil consumption between the nonpoint and nonroad sector emission inventories, the more detailed distillate oil consumption estimates reported in EIA's *Fuel Oil and Kerosene Sales* were combined with assumptions used in the regulatory impact analysis (RIA) for EPA's nonroad diesel emissions rulemaking (EIA, 2012c; EPA, 2003). Table 4 presents the assumptions that were applied to the state-level distillate oil consumption estimates to estimate total stationary source ICI consumption.

In order to avoid double-counting of LPG consumption, ERG used data from 2006 EPA National Mobile Inventory Model (NMIM) for 2006 and calculated the national volume of nonroad LPG consumption from agriculture, logging, mining, and construction source categories. This estimate was then divided into the SEDS total LPG consumption estimate to yield the proportion of total ICI LPG consumption attributable to the nonroad sector in that year (8.72% for industrial sources and 17.72% for commercial/institutional sources). It was assumed that these proportions were

appropriate for the 2011 inventory year. This estimate of the nonroad portion of LPG consumption was subtracted from each state's ICI LPG consumption estimate reported in SEDS.

Table 4. Assumptions Used to Estimate ICI Distillate Fuel Consumption

Sector	Distillate Fuel Type	% of Total Consumption from Stationary Sources
Industrial	No. 1 Distillate	60
	No. 2 Distillate (No. 2 Fuel Oil)	100
	No. 2 Distillate (Low Sulfur Diesel)	15[a]
	No. 2 Distillate (High Sulfur Diesel)	15[a]
	No. 4 Fuel Oil	100
Farm	Distillate Fuel Oil (Diesel)	0
	Distillate Fuel Oil (Other Distillate)	100
Off-Highway (Construction and Other)	Distillate Fuel Oil	5
Oil Company	Distillate Fuel Oil	50
Commercial/Institutional	No. 1 Distillate	80
	No. 2 Distillate (No. 2 Fuel Oil)	100
	No. 2 Distillate (Ultra-Low, Low, and High Sulfur Diesel)	0[b]
	No. 4 Fuel Oil	100

[a] This value differs from the 0% assumption adopted in EPA's nonroad diesel emissions rulemaking because it is known that some diesel fuel is used by stationary sources. A 15% value was selected for use as an approximate mid-point of a potential range of 8 to 24% stationary source use computed from a review of data from the EIA's *Manufacturing Energy Consumption Survey* and *Fuel Oil and Kerosene Sales*.
[b] A very small portion of total commercial/institutional diesel is consumed by point sources.

3.2 Non-Fuel Use Energy Adjustment

Some industrial sector energy is consumed for non-fuel purposes, such as natural gas that is used as a feedstock in chemical manufacturing plants and to make nitrogenous fertilizer, and LPG that is used to create intermediate products that are ultimately made into plastics. In order to estimate the volume of fuel that is associated with industrial combustion, it is necessary to subtract the volume of fuel consumption for non-energy uses from the volume of total fuel consumption.

The identification of feedstock usage was initially based upon the non-fuel use assumptions incorporated into the EIA's GHG emissions inventory for 2005 (EIA, 2007). The following fuels were assumed to be used entirely for non-fuel purposes: asphalt and road oil, feedstocks (naphtha <401 °F), feedstocks (other oils >401 °F), lubricants, miscellaneous petroleum products, pentanes plus, special naphthas, and waxes. In addition, it was also assumed that kerosene and motor gasoline were used entirely as fuel without any non-fuel purposes. The remaining fuels (i.e., coal [non-coke], distillate oil, LPG, natural gas, and residual oil) are used both for fuel and non-fuel purposes. The regional non-fuel fractions for distillate oil, LPG, natural gas, and residual oil were derived from non-fuel (feedstock) and total energy use statistics contained in EIA's *2006 Manufacturing Energy Consumption Survey (MECS)* (EIA, 2009); the 2010 MECS

has been conducted, but detailed data have not yet been released. This approach could not be used for non-coke coal because the 2006 MECS treats coal that is used to produce coke as a feedstock. Because of the limitations of the MECS data for non-coke coal, EIA previously provided a rough estimate of the percentage of non-coking coal that is used for non-fuel purposes (as well as treating “synthetic coal” as a fuel use). The estimate provided by EIA was that 5-10% of non-coke coal is used for non-fuel purposes (Lorenz, 2009); it was assumed that the midpoint of this range (i.e., 7.5%) is a reasonable estimate for the fraction of non-coke plant industrial sector coal consumption that is for non-fuel purposes.

Table 5 presents the regional non-fuel use percentages that were applied to estimate CenSARA states’ industrial fuel combustion activity.

Table 5. Industrial Sector Non-Fuel Use Estimates

Fuel	Fraction Non-Fuel Use by Region	
	South	Midwest
Distillate Oil	0.1154	0.2778
LPG	0.9878	0.8538
Natural Gas	0.1056	0.0371
Non-Coke Coal	0.0750	0.0750
Residual Oil	0.2995	0.1778

3.3 Point Source Energy Adjustment

Because the point source inventory also includes ICI combustion categories, it is necessary to subtract point source inventory fuel use from the EIA/SEDS fuel consumption estimates. Appendix A contains the crosswalks between ICI fuel combustion nonpoint SCCs and associated point SCCs that were used in the subtraction procedure. If the point source activity adjustment for any county in within a state resulted in a negative number, the point source adjustment was then performed after summing the point source throughput estimates to the state-level.

4.0 COUNTY ALLOCATION OF STATE ACTIVITY DATA

County-level activity estimates for 2010 were developed by allocating the state-level activity resulting from the adjustments to the EIA data described above. Compiled 2010 estimates of manufacturing and commercial sector employment from the Bureau of Census’ *County Business Patterns 2009* were used in this procedure (Census, 2012). Withheld *County Business Patterns* employment data were estimated based upon a technical memorandum previously developed for EPA (Divita, 2008). In addition, 2007 county-level estimates of institutional sector (NAICS code 92) employment were obtained from the 2007 *Census of Governments* (Census, 2009).[1] These were added to the county-level commercial sector employment to provide a combined estimate of county-level commercial and institutional employment.

[1] County-level federal and state government employment data are not available from the Bureau of the Census.

State-level ICI combustion estimates by fuel type were allocated to each county using the ratio of the number of employees in the industrial manufacturing sector (NAICS codes 31-33) and the commercial/institutional sector (NAICS codes 42-81, and 92) in each county to the total number of manufacturing and commercial/institutional sector employees in the state.

For the residential sector, state-level fuel consumption was allocated to each county using the U.S. Census Bureau's 2000 Census Detailed Housing Information (Census, 2000). These data include the number of housing units using a specific type of fuel for residential heating. State-level fuel consumption was allocated to each county using the ratio of the number of houses burning a particular fuel in each county to the total number of houses burning that fuel in the state.

5.0 EMISSION FACTORS

ERG compiled criteria and hazardous air pollutant emission factors for each nonpoint source fuel combustion category using EPA emission factors as the starting point. The criteria pollutant emission factors are presented in Appendix B. The majority of the emission factors are from the EPA/ERTAC2 database and EPA's *AP-42* report, Compilation of Air Pollutant Emission Factors (Huntley, 2009; EPA, 2010). The ammonia emission factors for wood combustion are from an Emission Inventory Improvement Program (EIIP) guidance document (EPA, 2004).

For coal combustion, the SO_2 emission factors are based on the sulfur content of the coal burned, and some of the PM emission factors for anthracite coal require information on the ash content of the coal. For the industrial and commercial/institutional sectors, state-specific coal sulfur contents for bituminous coal were obtained from the EIA's quarterly coal report (EIA, 2012d). For the residential sector, state-specific coal sulfur contents for bituminous coal were obtained from data compiled in preparing the 1999 residential coal combustion emissions estimates (EPA, 2002). Table 6 presents the bituminous coal sulfur content values used for each state. For anthracite coal, an ash content value of 13.38% and a sulfur content of 0.89% were applied to all states.

Table 6. State-Specific Sulfur Content for Bituminous Coal

State	% Industrial Sulfur Content	% Commercial/ Institutional Sulfur Content	% Residential Sulfur Content
Arkansas	1.59	1.23	1.20
Iowa	1.47	2.25	4.64
Kansas	2.77	1.23	5.83
Louisiana	0.88	1.23	0.86
Minnesota	0.37	1.94	0.97
Missouri	2.26	1.94	3.39
Nebraska	0.37	1.23	2.43
Oklahoma	0.53	1.23	3.08
Texas	0.82	1.23	1.14

HAP emission factors are from *AP-42* for the most part. Chromium was speciated as recommended by EPA for use in risk assessment studies; the toxicity of trivalent chromium is markedly lower than the toxicity of hexavalent chromium.

6.0 DEVELOPMENT OF AREA SOURCE EMISSION ESTIMATES

To develop the CenSARA states' ICI and residential fuel combustion emissions estimates for CAPs and HAPs, ERG developed the "CenSARA Fuel Combustion Activity Tool." The Tool was designed to assist agencies in compiling, allocating, and adjusting fuel combustion activity data, and developing county-level area source emission estimates for base year 2011 and future emission inventory cycles. Instructions for using the CenSARA Fuel Combustion Activity Tool are presented in Appendix C. The Tool is a state-specific Microsoft Access 2007 database that was designed to support different agency approaches for compiling, allocating, and adjusting area source fuel combustion activity data. To this end, the Tool is organized into State Level Activity and Allocation Tables, County Level Activity and Allocation Tables, and macros to be run after updates are made to the State and/or County Level Tables.

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Appendix A

SCC Point and Area Source Crosswalks

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
2102001000 - Stationary Source Fuel Combustion/Industrial/Anthracite Coal/Total: All Boiler Types				
10200101	External Combustion Boilers	Industrial	Anthracite Coal	Pulverized Coal
10200104	External Combustion Boilers	Industrial	Anthracite Coal	Traveling Grate (Overfeed) Stoker
10200107	External Combustion Boilers	Industrial	Anthracite Coal	Hand-fired
10200117	External Combustion Boilers	Industrial	Anthracite Coal	Fluidized Bed Boiler Burning Anthracite-Culm Fuel
39000189	Industrial Processes	In-process Fuel Use	Anthracite Coal	General
39000199	Industrial Processes	In-process Fuel Use	Anthracite Coal	General
2102002000 - Stationary Source Fuel Combustion/Industrial/Bituminous/Subbituminous Coal/ Total: All Boiler Types				
10200201	External Combustion Boilers	Industrial	Bituminous Coal	Pulverized Coal: Wet Bottom
10200202	External Combustion Boilers	Industrial	Bituminous Coal	Pulverized Coal: Dry Bottom
10200203	External Combustion Boilers	Industrial	Bituminous Coal	Cyclone Furnace
10200204	External Combustion Boilers	Industrial	Bituminous Coal	Spreader Stoker
10200205	External Combustion Boilers	Industrial	Bituminous Coal	Overfeed Stoker
10200206	External Combustion Boilers	Industrial	Bituminous Coal	Underfeed Stoker
10200210	External Combustion Boilers	Industrial	Bituminous Coal	Overfeed Stoker **
10200212	External Combustion Boilers	Industrial	Bituminous Coal	Pulverized Coal: Dry Bottom (Tangential)
10200213	External Combustion Boilers	Industrial	Bituminous Coal	Wet Slurry
10200217	External Combustion Boilers	Industrial	Bituminous Coal	Atmospheric Fluidized Bed Combustion: Bubbling Bed
10200218	External Combustion Boilers	Industrial	Bituminous Coal	Atmospheric Fluidized Bed Combustion: Circulating Bed
10200219	External Combustion Boilers	Industrial	Bituminous Coal	Cogeneration
10200221	External Combustion Boilers	Industrial	Subbituminous Coal	Pulverized Coal: Wet Bottom
10200222	External Combustion Boilers	Industrial	Subbituminous Coal	Pulverized Coal: Dry Bottom

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
10200223	External Combustion Boilers	Industrial	Subbituminous Coal	Cyclone Furnace
10200224	External Combustion Boilers	Industrial	Subbituminous Coal	Spreader Stoker
10200225	External Combustion Boilers	Industrial	Subbituminous Coal	Traveling Grate (Overfeed) Stoker
10200226	External Combustion Boilers	Industrial	Subbituminous Coal	Pulverized Coal: Dry Bottom Tangential
10200229	External Combustion Boilers	Industrial	Subbituminous Coal	Cogeneration
10500102	External Combustion	Space Heaters	Industrial	Coal **
39000201	Industrial Processes	In-process Fuel Use	Bituminous Coal	Cement Kiln/Dryer (Bituminous Coal)
39000203	Industrial Processes	In-process Fuel Use	Bituminous Coal	Lime Kiln (Bituminous)
39000288	Industrial Processes	In-process Fuel Use	Bituminous Coal	General (Subbituminous)
39000289	Industrial Processes	In-process Fuel Use	Bituminous Coal	General (Bituminous)
39000299	Industrial Processes	In-process Fuel Use	Bituminous Coal	General (Bituminous)
50390002	Waste Disposal	Solid Waste Disposal - Industrial	Auxiliary Fuel/No Emissions	Coal
210200400* - Stationary Source Fuel Combustion/Industrial/Distillate Oil/Total: Boilers and IC Engines				
10200501	External Combustion Boilers	Industrial	Distillate Oil	Grades 1 and 2 Oil
10200502	External Combustion Boilers	Industrial	Distillate Oil	10-100 Million BTU/hr **
10200503	External Combustion Boilers	Industrial	Distillate Oil	< 10 Million BTU/hr **
10200504	External Combustion Boilers	Industrial	Distillate Oil	Grade 4 Oil
10200505	External Combustion Boilers	Industrial	Distillate Oil	Cogeneration
10201403	External Combustion Boilers	Industrial	CO Boiler	Distillate Oil
10500105	External Combustion	Space Heaters	Industrial	Distillate Oil
20200101	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Turbine
20200102	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Reciprocating
20200103	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Turbine: Cogeneration
20200104	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Reciprocating: Cogeneration
20200105	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Reciprocating: Crankcase Blowby
20200106	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Reciprocating: Evaporative Losses (Fuel Storage and Delivery System)
20200107	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Reciprocating: Exhaust
20200108	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Turbine: Evaporative Losses (Fuel Storage and Delivery System)

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
20200109	Internal Combustion Engines	Industrial	Distillate Oil (Diesel)	Turbine: Exhaust
20200401	Internal Combustion Engines	Industrial	Large Bore Engine	Diesel
20200405	Internal Combustion Engines	Industrial	Large Bore Engine	Crankcase Blowby
20200406	Internal Combustion Engines	Industrial	Large Bore Engine	Evaporative Losses (Fuel Storage and Delivery System)
20200407	Internal Combustion Engines	Industrial	Large Bore Engine	Exhaust
27000320	Internal Combustion Engines	Off-highway Diesel Engines	Industrial Equipment	Industrial Fork Lift: Diesel
30190001	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters
30190011	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
30190021	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Distillate Oil (No. 2): Flares
30290001	Industrial Processes	Food and Agriculture	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters
30390001	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters
30390011	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
30390021	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Distillate Oil (No. 2): Flares
30400406	Industrial Processes	Secondary Metal Production	Lead	Pot Furnace Heater: Distillate Oil
30490001	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters
30490011	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
30490021	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Distillate Oil (No. 2): Flares
30490031	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Distillate Oil (No. 2): Furnaces
30500208	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Distillate Oil
30505022	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Heater: Distillate Oil
30590001	Industrial Processes	Mineral Products	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters
30590011	Industrial Processes	Mineral Products	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
30590021	Industrial Processes	Mineral Products	Fuel Fired Equipment	Distillate Oil (No. 2): Flares
30600901	Industrial Processes	Petroleum Industry	Flares	Distillate Oil
30609901	Industrial Processes	Petroleum Industry	Incinerators	Distillate Oil (No. 2)
30790001	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
30790011	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
30790021	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Distillate Oil (No. 2): Flares
30890001	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters
30890011	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
30890021	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Distillate Oil (No. 2): Flares
30990001	Industrial Processes	Fabricated Metal Products	Fuel Fired Equipment	Distillate Oil (No. 2): Process Heaters
30990011	Industrial Processes	Fabricated Metal Products	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
31000401	Industrial Processes	Oil and Gas Production	Process Heaters	Distillate Oil (No. 2)
31000411	Industrial Processes	Oil and Gas Production	Process Heaters	Distillate Oil (No. 2): Steam Generators
31390001	Industrial Processes	Electrical Equipment	Process Heaters	Distillate Oil (No. 2)
39000501	Industrial Processes	In-process Fuel Use	Distillate Oil	Asphalt Dryer **
39000502	Industrial Processes	In-process Fuel Use	Distillate Oil	Cement Kiln/Dryer
39000503	Industrial Processes	In-process Fuel Use	Distillate Oil	Lime Kiln
39000589	Industrial Processes	In-process Fuel Use	Distillate Oil	General
39000598	Industrial Processes	In-process Fuel Use	Distillate Oil	Grade 4 Oil: General
39000599	Industrial Processes	In-process Fuel Use	Distillate Oil	General
39900501	Industrial Processes	Miscellaneous Manufacturing Industries	Process Heater/Furnace	Distillate Oil
39990001	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Distillate Oil (No. 2): Process Heaters
39990011	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Distillate Oil (No. 2): Incinerators
39990021	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Distillate Oil (No. 2 Oil): Flares

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
40201002	Petroleum and Solvent Evaporation	Surface Coating Operations	Coating Oven Heater	Distillate Oil
40290011	Petroleum and Solvent Evaporation	Surface Coating Operations	Fuel Fired Equipment	Distillate Oil: Incinerator/Afterburner
49090011	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fuel Fired Equipment	Distillate Oil (No. 2): Incinerators
49090021	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fuel Fired Equipment	Distillate Oil (No. 2): Flares
50390005	Waste Disposal	Solid Waste Disposal - Industrial	Auxiliary Fuel/No Emissions	Distillate Oil
2102005000 - Stationary Source Fuel Combustion/Industrial/Residual Oil/Total: All Boiler Types				
10200401	External Combustion Boilers	Industrial	Residual Oil	Grade 6 Oil
10200402	External Combustion Boilers	Industrial	Residual Oil	10-100 Million BTU/hr **
10200403	External Combustion Boilers	Industrial	Residual Oil	< 10 Million BTU/hr **
10200404	External Combustion Boilers	Industrial	Residual Oil	Grade 5 Oil
10200405	External Combustion Boilers	Industrial	Residual Oil	Cogeneration
10201404	External Combustion Boilers	Industrial	CO Boiler	Residual Oil
20200501	Internal Combustion Engines	Industrial	Residual/Crude Oil	Reciprocating
20200505	Internal Combustion Engines	Industrial	Residual/Crude Oil	Reciprocating: Crankcase Blowby
20200506	Internal Combustion Engines	Industrial	Residual/Crude Oil	Reciprocating: Evaporative Losses (Fuel Storage and Delivery System)
20200507	Internal Combustion Engines	Industrial	Residual/Crude Oil	Reciprocating: Exhaust
30190002	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Residual Oil: Process Heaters
30190012	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Residual Oil: Incinerators
30190022	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Residual Oil: Flares
30290002	Industrial Processes	Food and Agriculture	Fuel Fired Equipment	Residual Oil: Process Heaters
30390002	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Residual Oil: Process Heaters
30390012	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Residual Oil: Incinerators
30390022	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Residual Oil: Flares
30490002	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Residual Oil: Process Heaters
30490012	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Residual Oil: Incinerators

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
30490022	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Residual Oil: Flares
30490032	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Residual Oil: Furnaces
30500207	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Residual Oil
30505021	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Heater: Residual Oil
30590002	Industrial Processes	Mineral Products	Fuel Fired Equipment	Residual Oil: Process Heaters
30590012	Industrial Processes	Mineral Products	Fuel Fired Equipment	Residual Oil: Incinerators
30600111	Industrial Processes	Petroleum Industry	Process Heaters	Oil-fired (No. 6 Oil) > 100 Million Btu Capacity
30600902	Industrial Processes	Petroleum Industry	Flares	Residual Oil
30609902	Industrial Processes	Petroleum Industry	Incinerators	Residual Oil
30790002	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Residual Oil: Process Heaters
30790012	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Residual Oil: Incinerators
30790022	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Residual Oil: Flares
30890002	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Residual Oil: Process Heaters
30890012	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Residual Oil: Incinerators
30890022	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Residual Oil: Flares
30990002	Industrial Processes	Fabricated Metal Products	Fuel Fired Equipment	Residual Oil: Process Heaters
30990012	Industrial Processes	Fabricated Metal Products	Fuel Fired Equipment	Residual Oil: Incinerators
31000402	Industrial Processes	Oil and Gas Production	Process Heaters	Residual Oil
31000412	Industrial Processes	Oil and Gas Production	Process Heaters	Residual Oil: Steam Generators
31390002	Industrial Processes	Electrical Equipment	Process Heaters	Residual Oil
39000402	Industrial Processes	In-process Fuel Use	Residual Oil	Cement Kiln/Dryer
39000403	Industrial Processes	In-process Fuel Use	Residual Oil	Lime Kiln
39000489	Industrial Processes	In-process Fuel Use	Residual Oil	General
39000499	Industrial Processes	In-process Fuel Use	Residual Oil	General

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
39990002	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Residual Oil: Process Heaters
39990012	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Residual Oil: Incinerators
39990022	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Residual Oil: Flares
40201003	Petroleum and Solvent Evaporation	Surface Coating Operations	Coating Oven Heater	Residual Oil
40290012	Petroleum and Solvent Evaporation	Surface Coating Operations	Fuel Fired Equipment	Residual Oil: Incinerator/Afterburner
49090012	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fuel Fired Equipment	Residual Oil: Incinerators
49090022	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fuel Fired Equipment	Residual Oil: Flares
2102006000 - Stationary Source Fuel Combustion/Industrial/Natural Gas/Total: Boilers and IC Engines				
10200601	External Combustion Boilers	Industrial	Natural Gas	> 100 Million BTU/hr
10200602	External Combustion Boilers	Industrial	Natural Gas	10-100 Million BTU/hr
10200603	External Combustion Boilers	Industrial	Natural Gas	< 10 Million BTU/hr
10200604	External Combustion Boilers	Industrial	Natural Gas	Cogeneration
10201401	External Combustion Boilers	Industrial	CO Boiler	Natural Gas
10500106	External Combustion	Space Heaters	Industrial	Natural Gas
20200201	Internal Combustion Engines	Industrial	Natural Gas	Turbine
20200202	Internal Combustion Engines	Industrial	Natural Gas	Reciprocating
20200203	Internal Combustion Engines	Industrial	Natural Gas	Turbine: Cogeneration
20200204	Internal Combustion Engines	Industrial	Natural Gas	Reciprocating: Cogeneration
20200205	Internal Combustion Engines	Industrial	Natural Gas	Reciprocating: Crankcase Blowby
20200206	Internal Combustion Engines	Industrial	Natural Gas	Reciprocating: Evaporative Losses (Fuel Delivery System)
20200207	Internal Combustion Engines	Industrial	Natural Gas	Reciprocating: Exhaust
20200208	Internal Combustion Engines	Industrial	Natural Gas	Turbine: Evaporative Losses (Fuel Delivery System)
20200209	Internal Combustion Engines	Industrial	Natural Gas	Turbine: Exhaust
20200251	Internal Combustion Engines	Industrial	Natural Gas	2-cycle Rich Burn
20200252	Internal Combustion Engines	Industrial	Natural Gas	2-cycle Lean Burn

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
20200253	Internal Combustion Engines	Industrial	Natural Gas	4-cycle Rich Burn
20200254	Internal Combustion Engines	Industrial	Natural Gas	4-cycle Lean Burn
20200255	Internal Combustion Engines	Industrial	Natural Gas	2-cycle Clean Burn
20200256	Internal Combustion Engines	Industrial	Natural Gas	4-cycle Clean Burn
30190003	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Natural Gas: Process Heaters
30190013	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Natural Gas: Incinerators
30190023	Industrial Processes	Chemical Manufacturing	Fuel Fired Equipment	Natural Gas: Flares
30290003	Industrial Processes	Food and Agriculture	Fuel Fired Equipment	Natural Gas: Process Heaters
30291001	Industrial Processes	Food and Agriculture	Fuel Fired Equipment	Broiling Food: Natural Gas
30390003	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Natural Gas: Process Heaters
30390013	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Natural Gas: Incinerators
30390023	Industrial Processes	Primary Metal Production	Fuel Fired Equipment	Natural Gas: Flares
30400407	Industrial Processes	Secondary Metal Production	Lead	Pot Furnace Heater: Natural Gas
30490003	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Natural Gas: Process Heaters
30490013	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Natural Gas: Incinerators
30490023	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Natural Gas: Flares
30490033	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Natural Gas: Furnaces
30500206	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: Natural Gas
30505020	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Heater: Natural Gas
30590003	Industrial Processes	Mineral Products	Fuel Fired Equipment	Natural Gas: Process Heaters
30590013	Industrial Processes	Mineral Products	Fuel Fired Equipment	Natural Gas: Incinerators
30590023	Industrial Processes	Mineral Products	Fuel Fired Equipment	Natural Gas: Flares
30600105	Industrial Processes	Petroleum Industry	Process Heaters	Natural Gas
30600903	Industrial Processes	Petroleum Industry	Flares	Natural Gas
30602401	Industrial Processes	Petroleum Industry	Reciprocating Engine Compressors	Natural Gas Fired
30609903	Industrial Processes	Petroleum Industry	Incinerators	Natural Gas

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
30790003	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Natural Gas: Process Heaters
30790013	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Natural Gas: Incinerators
30790023	Industrial Processes	Pulp and Paper and Wood Products	Fuel Fired Equipment	Natural Gas: Flares
30890003	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Natural Gas: Process Heaters
30890013	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Natural Gas: Incinerators
30890023	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Natural Gas: Flares
30990003	Industrial Processes	Fabricated Metal Products	Fuel Fired Equipment	Natural Gas: Process Heaters
30990013	Industrial Processes	Fabricated Metal Products	Fuel Fired Equipment	Natural Gas: Incinerators
30990023	Industrial Processes	Fabricated Metal Products	Fuel Fired Equipment	Natural Gas: Flares
31000404	Industrial Processes	Oil and Gas Production	Process Heaters	Natural Gas
31000414	Industrial Processes	Oil and Gas Production	Process Heaters	Natural Gas: Steam Generators
31390003	Industrial Processes	Electrical Equipment	Process Heaters	Natural Gas
39000602	Industrial Processes	In-process Fuel Use	Natural Gas	Cement Kiln/Dryer
39000603	Industrial Processes	In-process Fuel Use	Natural Gas	Lime Kiln
39000605	Industrial Processes	In-process Fuel Use	Natural Gas	Metal Melting **
39000689	Industrial Processes	In-process Fuel Use	Natural Gas	General
39000699	Industrial Processes	In-process Fuel Use	Natural Gas	General
39900601	Industrial Processes	Miscellaneous Manufacturing Industries	Process Heater/Furnace	Natural Gas
39990003	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Natural Gas: Process Heaters
39990013	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Natural Gas: Incinerators

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
39990023	Industrial Processes	Miscellaneous Manufacturing Industries	Miscellaneous Manufacturing Industries	Natural Gas: Flares
40201001	Petroleum and Solvent Evaporation	Surface Coating Operations	Coating Oven Heater	Natural Gas
40290013	Petroleum and Solvent Evaporation	Surface Coating Operations	Fuel Fired Equipment	Natural Gas: Incinerator/Afterburner
40290023	Petroleum and Solvent Evaporation	Surface Coating Operations	Fuel Fired Equipment	Natural Gas: Flares
49090013	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fuel Fired Equipment	Natural Gas: Incinerators
49090023	Petroleum and Solvent Evaporation	Organic Solvent Evaporation	Fuel Fired Equipment	Natural Gas: Flares
50390006	Waste Disposal	Solid Waste Disposal - Industrial	Auxiliary Fuel/No Emissions	Natural Gas
2102007000 - Stationary Source Fuel Combustion/Industrial/Liquified Petroleum Gas (LPG)/Total: All Boiler Types				
10201001	External Combustion Boilers	Industrial	Liquified Petroleum Gas (LPG)	Butane
10201002	External Combustion Boilers	Industrial	Liquified Petroleum Gas (LPG)	Propane
10201003	External Combustion Boilers	Industrial	Liquified Petroleum Gas (LPG)	Butane/Propane Mixture: Specify Percent Butane in Comments
10500110	External Combustion	Space Heaters	Industrial	Liquified Petroleum Gas (LPG)
20201001	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Propane: Reciprocating
20201002	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Butane: Reciprocating
20201005	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Reciprocating: Crankcase Blowby
20201006	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Reciprocating: Evaporative Losses (Fuel Storage and Delivery System)
20201007	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Reciprocating: Exhaust
20201008	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Turbine: Evaporative Losses (Fuel Storage and Delivery System)
20201009	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Turbine: Exhaust
20201011	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Turbine
20201012	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Reciprocating Engine
20201013	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Turbine: Cogeneration
20201014	Internal Combustion Engines	Industrial	Liquified Petroleum Gas (LPG)	Reciprocating Engine: Cogeneration
27300320	Internal Combustion Engines	Off-highway LPG-fueled Engines	Industrial Equipment	Industrial Fork Lift: Liquified Petroleum Gas (LPG)
30290005	Industrial Processes	Food and Agriculture	Fuel Fired Equipment	Liquified Petroleum Gas (LPG): Process Heaters

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
30490035	Industrial Processes	Secondary Metal Production	Fuel Fired Equipment	Propane: Furnaces
30500209	Industrial Processes	Mineral Products	Asphalt Concrete	Asphalt Heater: LPG
30505023	Industrial Processes	Mineral Products	Asphalt Processing (Blowing)	Asphalt Heater: LP Gas
30590005	Industrial Processes	Mineral Products	Fuel Fired Equipment	Liquified Petroleum Gas (LPG): Process Heaters
30600107	Industrial Processes	Petroleum Industry	Process Heaters	LPG-fired
30600905	Industrial Processes	Petroleum Industry	Flares	Liquified Petroleum Gas
30609905	Industrial Processes	Petroleum Industry	Incinerators	Liquified Petroleum Gas
30890004	Industrial Processes	Rubber and Miscellaneous Plastics Products	Fuel Fired Equipment	Liquified Petroleum Gas (LPG): Process Heaters
31000406	Industrial Processes	Oil and Gas Production	Process Heaters	Propane/Butane
39001089	Industrial Processes	In-process Fuel Use	Liquified Petroleum Gas	General
39001099	Industrial Processes	In-process Fuel Use	Liquified Petroleum Gas	General
39901001	Industrial Processes	Miscellaneous Manufacturing Industries	Process Heater/Furnace	LPG
40201004	Petroleum and Solvent Evaporation	Surface Coating Operations	Coating Oven Heater	Liquified Petroleum Gas (LPG)
50390010	Waste Disposal	Solid Waste Disposal - Industrial	Auxiliary Fuel/No Emissions	Liquified Petroleum Gas (LPG)
2102008000 - Stationary Source Fuel Combustion/Industrial/Wood/Total: All Boiler Types				
10200901	External Combustion Boilers	Industrial	Wood/Bark Waste	Bark-fired Boiler
10200902	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood/Bark-fired Boiler
10200903	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood-fired Boiler - Wet Wood (>=20% moisture)
10200904	External Combustion Boilers	Industrial	Wood/Bark Waste	Bark-fired Boiler (< 50,000 Lb Steam) **
10200905	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood/Bark-fired Boiler (< 50,000 Lb Steam) **
10200906	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood-fired Boiler (< 50,000 Lb Steam) **
10200907	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood Cogeneration
10200908	External Combustion Boilers	Industrial	Wood/Bark Waste	Wood-fired Boiler - Dry Wood (<20% moisture)
10200910	External Combustion Boilers	Industrial	Wood/Bark Waste	Fuel cell/Dutch oven boilers **
10200911	External Combustion Boilers	Industrial	Wood/Bark Waste	Stoker boilers **
10200912	External Combustion Boilers	Industrial	Wood/Bark Waste	Fluidized bed combustion boiler
39000989	Industrial Processes	In-process Fuel Use	Wood	General

Table A-1. Industrial Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
39000999	Industrial Processes	In-process Fuel Use	Wood	General: Wood
2102011000 - Stationary Source Fuel Combustion/Industrial/Kerosene/Total: All Boiler Types				
20200901	Internal Combustion Engines	Industrial	Kerosene/Naphtha (Jet Fuel)	Turbine
20200902	Internal Combustion Engines	Industrial	Kerosene/Naphtha (Jet Fuel)	Reciprocating
20200905	Internal Combustion Engines	Industrial	Kerosene/Naphtha (Jet Fuel)	Reciprocating: Crankcase Blowby
20200906	Internal Combustion Engines	Industrial	Kerosene/Naphtha (Jet Fuel)	Reciprocating: Evaporative Losses (Fuel Storage and Delivery System)
20200907	Internal Combustion Engines	Industrial	Kerosene/Naphtha (Jet Fuel)	Reciprocating: Exhaust
20200908	Internal Combustion Engines	Industrial	Kerosene/Naphtha (Jet Fuel)	Turbine: Evaporative Losses (Fuel Storage and Delivery System)
20200909	Internal Combustion Engines	Industrial	Kerosene/Naphtha (Jet Fuel)	Turbine: Exhaust
20400110	Internal Combustion Engines	Engine Testing	Aircraft Engine Testing	Jet A Fuel
20400111	Internal Combustion Engines	Engine Testing	Aircraft Engine Testing	JP-5 Fuel
20400112	Internal Combustion Engines	Engine Testing	Aircraft Engine Testing	JP-4 Fuel
20400406	Internal Combustion Engines	Engine Testing	Reciprocating Engine	Kerosene/Naphtha (Jet Fuel)

Table A-2. Commercial/Institutional Fuel Combustion Crosswalk for Point Source Subtractions

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
2103001000 - Stationary Source Fuel Combustion/Commercial/Institutional/Anthracite Coal/Total: All Boiler Types				
10300101	External Combustion Boilers	Commercial/Institutional	Anthracite Coal	Pulverized Coal
10300102	External Combustion Boilers	Commercial/Institutional	Anthracite Coal	Traveling Grate (Overfeed) Stoker
10300103	External Combustion Boilers	Commercial/Institutional	Anthracite Coal	Hand-fired
2103002000 - Stationary Source Fuel Combustion/Commercial/Institutional/Bituminous/Subbituminous Coal/Total: All Boiler Types				
10300203	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Cyclone Furnace
10300205	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Pulverized Coal: Wet Bottom
10300206	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Pulverized Coal: Dry Bottom
10300207	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Overfeed Stoker
10300208	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Underfeed Stoker
10300209	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Spreader Stoker
10300211	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Overfeed Stoker **
10300214	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Hand-fired
10300216	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Pulverized Coal: Dry Bottom (Tangential)
10300217	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Atmospheric Fluidized Bed Combustion: Bubbling Bed
10300218	External Combustion Boilers	Commercial/Institutional	Bituminous Coal	Atmospheric Fluidized Bed Combustion: Circulating Bed
10300221	External Combustion Boilers	Commercial/Institutional	Subbituminous Coal	Pulverized Coal: Wet Bottom
10300222	External Combustion Boilers	Commercial/Institutional	Subbituminous Coal	Pulverized Coal: Dry Bottom
10300223	External Combustion Boilers	Commercial/Institutional	Subbituminous Coal	Cyclone Furnace
10300224	External Combustion Boilers	Commercial/Institutional	Subbituminous Coal	Spreader Stoker
10300225	External Combustion Boilers	Commercial/Institutional	Subbituminous Coal	Traveling Grate (Overfeed) Stoker
10300226	External Combustion Boilers	Commercial/Institutional	Subbituminous Coal	Pulverized Coal: Dry Bottom Tangential

Table A-2. Commercial/Institutional Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
10500202	External Combustion	Space Heaters	Commercial/Institutional	Coal **
50190002	Waste Disposal	Solid Waste Disposal - Government	Auxiliary Fuel/No Emissions	Coal
50290002	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Auxiliary Fuel/No Emissions	Coal
210300400* - Stationary Source Fuel Combustion/Commercial/Institutional/Distillate Oil/Total: Boilers and IC Engines				
10300501	External Combustion Boilers	Commercial/Institutional	Distillate Oil	Grades 1 and 2 Oil
10300502	External Combustion Boilers	Commercial/Institutional	Distillate Oil	10-100 Million BTU/hr **
10300503	External Combustion Boilers	Commercial/Institutional	Distillate Oil	< 10 Million BTU/hr **
10300504	External Combustion Boilers	Commercial/Institutional	Distillate Oil	Grade 4 Oil
10500205	External Combustion	Space Heaters	Commercial/Institutional	Distillate Oil
20300101	Internal Combustion Engines	Commercial/Institutional	Distillate Oil (Diesel)	Reciprocating
20300102	Internal Combustion Engines	Commercial/Institutional	Distillate Oil (Diesel)	Turbine
20300105	Internal Combustion Engines	Commercial/Institutional	Distillate Oil (Diesel)	Reciprocating: Crankcase Blowby
20300106	Internal Combustion Engines	Commercial/Institutional	Distillate Oil (Diesel)	Reciprocating: Evaporative Losses (Fuel Storage and Delivery System)
20300107	Internal Combustion Engines	Commercial/Institutional	Distillate Oil (Diesel)	Reciprocating: Exhaust
20300108	Internal Combustion Engines	Commercial/Institutional	Distillate Oil (Diesel)	Turbine: Evaporative Losses (Fuel Storage and Delivery System)
20300109	Internal Combustion Engines	Commercial/Institutional	Distillate Oil (Diesel)	Turbine: Exhaust
50100602	Waste Disposal	Solid Waste Disposal - Government	Fire Fighting	Structure: Distillate Oil
50190005	Waste Disposal	Solid Waste Disposal - Government	Auxiliary Fuel/No Emissions	Distillate Oil
50290005	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Auxiliary Fuel/No Emissions	Distillate Oil
2103005000 - Stationary Source Fuel Combustion/Commercial/Institutional/Residual Oil/Total: All Boiler Types				
10300401	External Combustion Boilers	Commercial/Institutional	Residual Oil	Grade 6 Oil
10300402	External Combustion Boilers	Commercial/Institutional	Residual Oil	10-100 Million BTU/hr **

Table A-2. Commercial/Institutional Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
10300403	External Combustion Boilers	Commercial/Institutional	Residual Oil	< 10 Million BTU/hr **
10300404	External Combustion Boilers	Commercial/Institutional	Residual Oil	Grade 5 Oil
2103006000 - Stationary Source Fuel Combustion/Commercial/Institutional/Natural Gas/Total: Boilers and IC Engines				
10300601	External Combustion Boilers	Commercial/Institutional	Natural Gas	> 100 Million BTU/hr
10300602	External Combustion Boilers	Commercial/Institutional	Natural Gas	10-100 Million BTU/hr
10300603	External Combustion Boilers	Commercial/Institutional	Natural Gas	< 10 Million BTU/hr
10500206	External Combustion	Space Heaters	Commercial/Institutional	Natural Gas
20300201	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Reciprocating
20300202	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Turbine
20300203	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Turbine: Cogeneration
20300204	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Cogeneration
20300205	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Reciprocating: Crankcase Blowby
20300206	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Reciprocating: Evaporative Losses (Fuel Delivery System)
20300207	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Reciprocating: Exhaust
20300208	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Turbine: Evaporative Losses (Fuel Delivery System)
20300209	Internal Combustion Engines	Commercial/Institutional	Natural Gas	Turbine: Exhaust
50190006	Waste Disposal	Solid Waste Disposal - Government	Auxiliary Fuel/No Emissions	Natural Gas
50290006	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Auxiliary Fuel/No Emissions	Natural Gas
2103007000 - Stationary Source Fuel Combustion/Commercial/Institutional/Liquified Petroleum Gas (LPG)/Total: All Combustor Types				
10301001	External Combustion Boilers	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Butane
10301002	External Combustion Boilers	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Propane

Table A-2. Commercial/Institutional Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
10301003	External Combustion Boilers	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Butane/Propane Mixture: Specify Percent Butane in Comments
10500210	External Combustion	Space Heaters	Commercial/Institutional	Liquified Petroleum Gas (LPG)
20301001	Internal Combustion Engines	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Propane: Reciprocating
20301002	Internal Combustion Engines	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Butane: Reciprocating
20301005	Internal Combustion Engines	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Reciprocating: Crankcase Blowby
20301006	Internal Combustion Engines	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Reciprocating: Evaporative Losses (Fuel Storage and Delivery System)
20301007	Internal Combustion Engines	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Reciprocating: Exhaust
50190010	Waste Disposal	Solid Waste Disposal - Government	Auxiliary Fuel/No Emissions	Liquified Petroleum Gas (LPG)
50290010	Waste Disposal	Solid Waste Disposal - Commercial/Institutional	Auxiliary Fuel/No Emissions	Liquified Petroleum Gas (LPG)
2103008000 - Stationary Source Fuel Combustion/Commercial/Institutional/Wood/Total: All Boiler Types				
10300901	External Combustion Boilers	Commercial/Institutional	Wood/Bark Waste	Bark-fired Boiler
10300902	External Combustion Boilers	Commercial/Institutional	Wood/Bark Waste	Wood/Bark-fired Boiler
10300903	External Combustion Boilers	Commercial/Institutional	Wood/Bark Waste	Wood-fired Boiler - Wet Wood (>=20% moisture)
10300908	External Combustion Boilers	Commercial/Institutional	Wood/Bark Waste	Wood-fired Boiler - Dry Wood (<20% moisture)
10300910	External Combustion Boilers	Commercial/Institutional	Wood/Bark Waste	Fuel cell/Dutch oven boilers **
10300911	External Combustion Boilers	Commercial/Institutional	Wood/Bark Waste	Stoker boilers **
10300912	External Combustion Boilers	Commercial/Institutional	Wood/Bark Waste	Fluidized bed combustion boilers
10500209	External Combustion	Space Heaters	Commercial/Institutional	Wood
2103011000 - Stationary Source Fuel Combustion/Commercial/Institutional/Kerosene/Total: All Combustor Types				
20300901	Internal Combustion Engines	Commercial/Institutional	Kerosene/Naphtha (Jet Fuel)	Turbine: JP-4
20300908	Internal Combustion Engines	Commercial/Institutional	Kerosene/Naphtha (Jet Fuel)	Turbine: Evaporative Losses (Fuel Storage and Delivery System)

Table A-2. Commercial/Institutional Fuel Combustion Crosswalk for Point Source Subtractions (Cont.)

Point SCC	SCC1 DESC	SCC3 DESC	SCC6 DESC	SCC8 DESC
20300909	Internal Combustion Engines	Commercial/Institutional	Kerosene/Naphtha (Jet Fuel)	Turbine: Exhaust
50100603	Waste Disposal	Solid Waste Disposal - Government	Fire Fighting	Structure: Kerosene

Appendix B

Criteria Pollutant Emission Factors for ICI and Residential Combustion Area Source Categories

Table B-1. Criteria Pollutant Emission Factors for ICI and Residential Combustion Area Source Categories

SCC	Description	Emission Factor Units[1]	VOC	NO_x	CO	SO_2	$PM_{2.5}$-FIL	PM_{10}-FIL	PM-CON	NH_3
2102001000	Industrial Anthracite Coal	lb/ton	0.3	9	0.6	39 * S%	0.48 * A%	1.1 * A%	0.08 * A%	0.03
2102002000	Industrial Bitum/Subbitum Coal	lb/ton	0.05	11	5	38 * S%	1.4	12	1.04	0.03
2102004001	Industrial Distillate Oil: Boilers	lb/1000 gal	0.2	20	5	142 * S%	0.25	1.0	1.3	0.08
2102004002	Industrial Distillate Oil: IC Engines	lb/1000 gal	0.2[2]	604	130	39.8	42.5	42.5	1.0	0.8[2]
2102005000	Industrial Residual Oil	lb/1000 gal	0.28	55	5	157 * S%	4.67 * (1.12 * S% + 0.37)	7.17 * (1.12 * S% + 0.37)	1.5	0.8
2102006000	Industrial Natural Gas	lb/MMcf	5.5	100	84	0.6	0.11	0.2	0.32	0.49[7]
2102007000	Industrial LPG[3]	lb/1000 bbl	0.52	14.23	7.97	0.06	0.01	0.02	0.03	0.05
2102008000	Industrial Wood[4]	lb/MMBtu	0.017	0.22	0.6	0.025	0.43	0.5	0.017	0.007[5]
2102011000	Industrial Kerosene	lb/1000 gal	0.19	19.29	4.82	142 * S%	0.24	0.96	1.25	0.771
2103001000	Comm/Inst Anthracite Coal	lb/ton	0.3	9	0.6	39 * S%	0.48 * A%	1.1 * A%	0.08 * A%	0.03
2103002000	Comm/Inst Bitum/Subbitum Coal	lb/ton	0.05	11	5	38 * S%	1.4	12	1.04	0.03
2103004001	Comm/Inst Distillate Oil: Boilers	lb/1000 gal	0.34	20	5	142 * S%	0.83	1.08	1.3	0.8
2103004002	Comm/Inst Distillate Oil: IC Engines	lb/1000 gal	0.34[2]	604	130	39.8	42.5	42.5	1.0	0.8[2]
2103005000	Comm/Inst Residual Oil	lb/1000 gal	1.13	55	5	157 * S%	1.92 * (1.12 * S% + 0.37)	5.17 * (1.12 * S% + 0.37)	1.5	0.8
2103006000	Comm/Inst Natural Gas	lb/MMcf	5.5	100	84	0.6	0.11	0.2	0.32	0.49
2103007000	Comm/Inst LPG	lb/1000 bbl	0.52	14.23	7.97	0.06	0.01	0.02	0.03	0.05
2103008000	Comm/Inst Wood[4]	lb/MMBtu	0.017	0.22	0.6	0.025	0.43	0.5	0.017	0.005[5]
2103011000	Comm/Inst Kerosene	lb/1000 gal	0.33	19.29	4.82	142 * S%	0.8	1.04	1.25	0.771
2104001000	Residential Anthracite Coal	lb/ton	10	3	275	39 * S%	0.6 * A%	10	0.08 * A%	2
2104002000	Residential Bitum/Subbitum Coal	lb/ton	10	9.1	275	31 * S%	3.8	6.2	1.04	2
2104004000	Residential Distillate Oil	lb/1000 gal	0.7	18	5	142 * S%	0.83	1.08	1.3	1
2104005000	Residential Residual Oil[6]	lb/1000 gal	0.7	18	5	142 * S%	0.83	1.08	1.3	1
2104006000	Residential Natural Gas	lb/MMcf	5.5	94	40	0.6	0.11	0.2	0.32	20
2104007000	Residential LPG	lb/1000 bbl	21.91	562.8	159.6	2.39	0.4382	0.7968	1.275	1.952
2104011000	Residential Kerosene	lb/1000 bbl	28.35	729	202.5	1,725.3	33.615	43.74	52.65	40.5

Source: Unless otherwise noted, 2008 nonpoint source NEI (Huntley, 2009).

Notes:
[1] lb = pound; ton = short ton; gal = gallon; MMcf = million cubic feet; MMBtu = million British thermal units; bbl = barrels; S = sulfur content; A = ash Content
[2] Emission factor from SCC 2102004000 or 21002005000.
[3] Emission factors from commercial/institutional LPG.
[4] Emission factors from *AP-42*, Section 1.6, Wood Residue Combustion in Boilers (EPA, 2003).
[5] Emission factor from Pechan, 2004 (converted from lb/ton using 0.08 ton/MMBtu for industrial sector and 0.0625 ton/MMBtu for commercial sector).
[6] Emission factors from *AP-42*, Section 1.3, Fuel Oil Combustion, and from Residential Distillate Oil.
[7] ERG believes that there is an error in the EPA ERTAC emission factor workbook (Huntley, 2009) for this emission factor (EF). The change log in the ERTAC workbook conflicts with the emission factors spreadsheet.

Appendix C

User's Guide for the CenSARA Fuel Combustion Activity Tool

Instructions for Using the CenSARA Fuel Combustion Activity Tool

1.0 Introduction

CenSARA tasked Eastern Research Group (ERG) to develop a tool that state, local, and tribal agencies could use to develop an area source emission inventory for industrial, commercial/institutional (ICI), and residential fuel combustion. To this end, ERG prepared the CenSARA Fuel Combustion Activity Tool to assist agencies in compiling, allocating, and adjusting fuel combustion activity data, and developing county-level area source emission estimates.

The CenSARA Fuel Combustion Activity Tool is a state-specific Microsoft Access 2007 file. Because different approaches can be implemented to compile, allocate, and adjust area source fuel combustion activity data, the tables, queries, and macros in the Tool are organized into 5 "Groups:" Master Table, Group 1 State Level Activity and Allocation Tables, Group 2 County Level Activity and Allocation Tables, Reference Tables, and a Group of three macros to be run after updates are made to the Group 1 and Group 2 Tables.

In order to view and edit tables or run the macros in the Groups listed above, expand the window for that Group by clicking the Group name. For example, if you want to expand Group 2 in order to review and edit the county level activity data, click the Group 2 name "Group 2 County Level Activity Tables and Emission Factors" as shown in Figure 1.

2.0 Description of Tables

1. **CenSARA_ICI_Res_Master Table** – The Master Table contains the state, county, SCC, default activity, point source activity, area source activity, emissions factors and estimates, and EIS-ready fields. The fields included in the Master Table are shown in Table 1, along with a description of what each field contains. The Master Table is populated with the data that can be reviewed and used to populate the EIS staging tables. Revisions made to the Group 1 and Group 2 Tables are incorporated into the Master Table after the associated state level and/or county level Macros are run. Any revisions or updates needed should be made in the Group 1 and Group 2 Tables, not the Master Table.

2. **Group 1 <u>State Level</u> Activity and Allocation Tables** – The Group 1 State Level Tables contain the raw EIA/SEDS default state level input, input fields for non-fuel use adjustments, and input fields for county-level allocations.

    a. **Group1a ICI State Level Activity and Allocation Tables ICI** – These tables contain the raw EIA/SEDs state level activity data, fields for making state level adjustments for non-fuel use, and fields for allocating the ICI state level data to the county level. A list of the tables in Group 1a is shown in Table 2.

    b. **Group 1b Residential State Level Activity and Allocation** – These tables contain the raw EIA/SEDs state level activity data, and fields for allocating the residential data to the county level. A list of the tables in Group 1b is shown in Table 3.

    c. **Group 1c Intermediate Tables** – These tables can be used to review the updates made to the Group 1a and 1b Tables. A list of the tables in Group 1a is shown in Table 4.

3. **Group 2 <u>County Level</u> Activity Tables and Emission Factors** – The Group 2 County Level Tables contain the county level activity data developed from the Group 1 Tables. The county level activity is used to estimate emissions. This group also includes a table of emission factors and a table for entering point source activity at the county level. A list of the tables in Group 1 is shown in Table 5.

4. **Macros** – This Group contains 3 Macros (shown in Table 6) to run after changes are made to Group 1 <u>State Level</u> tables (Macro 01), the Group 2 <u>County Level</u> tables (Macro 02), and to make point source adjustments and calculate emissions (Macro 03).

5. **Reference Tables** – This Group contains four tables provided as a reference for states. The lookups include a conversion table, pollutant type lookup, SCC lookup, and SCC crosswalk for point and area source SCCs. This group also contains a run log that indicates when the macros were last run.

6. **Unassigned Objects** – This group contains the queries and background tables needed in order to run the macros. Users should not need to make updates to tables or queries in this group.

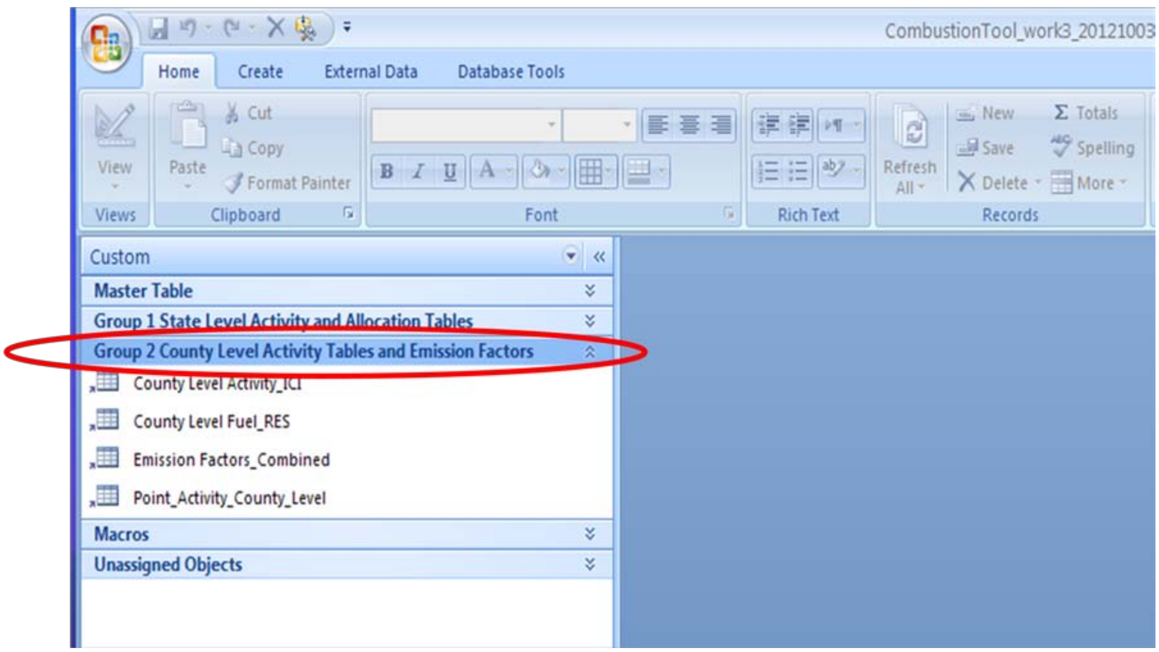

Figure 1. Click to Expand the Group 2 County Level Activity Tables and Emission Factors.

Section 3.0 Instructions for Making Revisions

If you are revising tables in more than one Group, it is important to follow the order of the steps below. As you make changes in one Group and run the corresponding macro, changes are made to the other Group. If you revise the Master table and then revise tables in Group 1 or Group 2 and run the macros, your changes to the Master table will be overwritten.

1. Revise the Group 1 State Level tables as needed. The types of updates that could be made here include updating raw EIA/SEDS data for future years, updating county business patterns to use in allocations, changing the nonroad adjustment percentages for ICI for future years, providing state total point source activity, etc.

2. If you did not revise Group 1, go to step 3 below. If revisions were made in Group 1, run the macro called "01 Use State Level Activity to Update County Level Activity." This macro will recreate the Group 2 county level activity tables using your revised data from Group 1. To run the macro, double click the name of the macro. When the macro is finished, you will see a pop up message letting you know it is complete.

3. Review and revise Group 2 as needed. The types of updates that could be made here include revising the county level activity data, revising emission factors, and providing point source activity at the county level. Note that if you revise the ash or sulfur content for coal, distillate oil, or residual oil, you will need to manually re-calculate the PM and/or SO_2 emission factors (using equations provided in the Final Report). Also note that lead is currently flagged as a HAP; EPA's EIS flags it as a CAP.

4. If you did not revise Group 1 or Group 2 above, go to step 5 below. If you made revisions in Group 1 or Group 2 above, run Macro 02 to incorporate revisions into the Master Table. To run the macro, double click the name of the macro. When the macro is finished, you will see a pop up message letting you know it is complete.

5. Review the emission factors, default activity, or point source activity in the Master Table as needed.

6. If you did not make changes to Group 1, Group 2, or the Master table, you do not need to run any of the Macros. If you made changes, run Macro 03 to recalculate emissions. ***Note that Macro 03 repopulates the Area Activity field. If you want to use your own county level combustion activity data instead of the EPA defaults, you should enter the activity in the corresponding tables in Group 2 instead of entering it in the Master Table.*

Table 1. Fields Included in the CenSARA_ICI_Res_Master_Table

Field Names	Description
StateAndCountyFIPSCode	Combined state and county FIPs codes
FIPS State Code	State FIPS code
Postal State Code	State abbreviation
StateName	State name
FIPS County Code	County FIPS code
CountyName	County name
TribalCode	Tribal code
TribalName	Tribal name
SourceClassificationCode	SCC
Source Classification Code Description	SCC short description
PollutantCode	EIS pollutant code
Pollutant Code Description	Pollutant name
Type	Pollutant type (e.g., CAP, HAP, GHG)[a]
Default Activity	Default activity (based on adjusted EIA/SEDS data)
Default Activity Units	Default activity units (e.g., ton, thousand gallons, thousand barrels, million cubic feet)
State-Level Point Activity Provided	Populated with “Y” if state level point source activity were entered the Group 1a Table
Point Activity	User-supplied (or calculated) point source county-level activity data as calculated based on Group 1a allocated data, or entered in Group 2 table
Point Activity Units	Point source activity units
Area Activity	User-supplied (or calculated) area source county-level activity data
Area Activity Units	Area source activity units
EmissionFactor	Emission factor
EmissionFactorNumeratorUnitofMeasureCode	Emission factor numerator
EmissionFactorDenominatorUnitofMeasureCode	Emission factor denominator
TotalEmissions	Estimated, adjusted, county-level emissions
EmissionsUnitofMeasureCode	Emission estimate units
CalculationParameterValue	EIS activity data field
CalculationParameterUnitofMeasure	EIS field for activity units
CalculationParameterTypeCode	EIS code for basis of estimate (e.g., I = (Fuel Input)
CalculationMaterialCode	EIS code for fuel type
CalculationDataYear	Base year (e.g., 2011)
ReportingPeriodTypeCode	Type of estimate (e.g., A= Annual)
EmissionCalcMethodCode	Numerical flag to indicate the emission factor source.

[a] Lead is flagged as a HAP in the CenSARA Tool.

Table 2. Group 1a ICI State Level Activity and Allocation Tables ICI

Table Name	Description
Coal_Types	Used for ICI type of coal adjustment (e.g., % anthracite, bituminous/subbituminous)
Commercial_Allocations	Used for C/I allocation to county based on employment
Commercial_Boiler_Engine_Split[a]	Used to split distillate usage between boilers and engines
County Information	County lookup reference table
Distillate_Nonroad	Calculates the percent of nonroad distillate usage for adjustment
Industrial_Allocations	Used for industrial allocation to county based on employment
Industrial_Boiler_Engine_Split[a]	Used to split distillate usage between boilers and engines
LPG_Nonroad_Percent	Percent of nonroad LPG for adjustment
MECS_FuelUse_AllPurposes	Activity data used for non-fuel use adjustment
MECS_NonFuelUse_Feedstock	Activity data used for non-fuel use adjustment
Point_Activity_State_Level	User-supplied state level point source activity
SEDS_Activity_Raw	Raw EIA/SEDS activity data
State_to_Region_Crosswalk	Used for non-fuel use adjustment to region (e.g., South, Midwest)

[a] Be sure to allocate point source activity between these two SCCs.

Table 3. Group 1b Residential State Level Activity and Allocation

Table Name	Description
Housing Units - 2000 Census	Used for residential allocation to county based on housing fuel usage
Res_Coal	State level activity data for coal
Res_Distillate	State level activity data for distillate
Res_Kerosene	State level activity data for kerosene
Res_LPG	State level activity data for LPG
Res_NaturalGas	State level activity data for natural gas
SCC	Lookup used for residential queries

Table 4. Group 1C Intermediate Tables

Table Name	Description
Res_all	Summary of state level residential fuel combustion activity
SEDS_Activity_Adjusted	Summary of adjusted state level ICI fuel combustion activity

Table 5. Group 2 County Level Tables

Table Name	Type	Description
County Level Activity_ICI	ICI	Adjusted EIA/SEDS ICI activity data at the county level
County Level Fuel_RES	Residential	Residential fuel use at the county level
Emission Factors_Combined	Both	Emission factors by SCC, pollutant, and state
Point_Activity_County_Level	ICI	User-supplied or calculated county level point source activity

Table 6. Macros

Macro Name	Description
01 Use State Level Activity to Update County Level Activity	Uses the Group 1 State Level Tables to create the County Level Activity ICI and County Level Fuel RES Tables in Group 2
02 Update Master Table with Activity and Emission Factors	Uses the Group 2 County Level Tables to update the CenSARA Master Table
03 Make Point Source Adjustment and Calculate Emissions	Adjusts the default activity based on point activity to calculate final area activity and emissions

Missouri used the CenSARA Fuel Combustion Activity Tool to provide emission estimates for Industrial, Commercial/Institutional (ICI), and Residential fuel combustion categories. Residential wood combustion is not calculated by this methodology and is included as a separate nonpoint category. The following discussion covers Missouri's state-specific work with CenSARA's tool to arrive at a final nonpoint combustion emission estimate. Following Missouri's state-specific discussion is the contractor provided documentation of the tool, including data resources used, emission factors, and point-nonpoint SCC crosswalks.

Missouri's analysis covers the 25 SCC codes in this category:

SCC	Source Classification Code Description
2102001000	Stationary Fuel Comb /Industrial /Anthracite Coal /Total: All Boiler Types
2102002000	Stationary Fuel Comb /Industrial /Bituminous/Subbituminous Coal /Total: All Boiler Types
2102004001	Stationary Fuel Comb /Industrial /Distillate Oil /Boilers
2102004002	Stationary Fuel Comb /Industrial /Distillate Oil /IC Engines
2102005000	Stationary Fuel Comb /Industrial /Residual Oil /Total: All Boiler Types
2102006000	Stationary Fuel Comb /Industrial /Natural Gas /Total: Boilers and IC Engines
2102007000	Stationary Fuel Comb /Industrial /Liquified Petroleum Gas /Total: All Boiler Types
2102008000	Stationary Fuel Comb /Industrial /Wood /Total: All Boiler Types
2102011000	Stationary Fuel Comb /Industrial /Kerosene /Total: All Boiler Types
2103001000	Stationary Fuel Comb /Commercial/Institutional /Anthracite Coal /Total: All Boiler Types
2103002000	Stationary Fuel Comb /Commercial/Institutional /Bituminous/Subbituminous Coal /Total: All Boiler Types
2103004001	Stationary Fuel Comb /Commercial/Institutional /Distillate Oil /Boilers
2103004002	Stationary Fuel Comb /Commercial/Institutional /Distillate Oil /IC Engines
2103005000	Stationary Fuel Comb /Commercial/Institutional /Residual Oil /Total: All Boiler Types
2103006000	Stationary Fuel Comb /Commercial/Institutional /Natural Gas /Total: Boilers and IC Engines
2103007000	Stationary Fuel Comb /Commercial/Institutional /Liquified Petroleum Gas /Total: All Combustor Types
2103008000	Stationary Fuel Comb /Commercial/Institutional /Wood /Total: All Boiler Types
2103011000	Stationary Fuel Comb /Commercial/Institutional /Kerosene /Total: All Combustor Types
2104001000	Stationary Fuel Comb /Residential /Anthracite Coal /Total: All Combustor Types
2104002000	Stationary Fuel Comb /Residential /Bituminous/Subbituminous Coal /Total: All Combustor Types
2104004000	Stationary Fuel Comb /Residential /Distillate Oil /Total: All Combustor Types
2104006000	Stationary Fuel Comb /Residential /Natural Gas /Total: All Combustor Types
2104007000	Stationary Fuel Comb /Residential /Liquified Petroleum Gas /Total: All Combustor Types
2104011000	Stationary Fuel Comb /Residential /Kerosene /Total: All Heater Types

The method provides estimates for CAP, HAP, and GHG emissions. Missouri submitted the 91 HAPs and GHG pollutants voluntarily to the NEI.

Checks of the CenSARA Tool:

Missouri and the other CenSARA states reviewed the data within the tool (activity, nonpoint fuel use, allocation method, emission factors) and found the following issues:

1. EIS does not accept pollutant code 40 because the emissions are also calculated for each individual species of PAH. The emissions for this pollutant code are removed from the data file submitted to EPA.

2. There are duplicate EFs in the EF table:
    - Lead emission factors have duplicates for 2013004001 and 2104004001. EF citations are from webFIRE or AP-42 Section 1.3. Since the webFIRE factor could not be found, the AP-42 factor is used. The factor is also corrected from 1.25 E-03 to 1.51E-03 to match AP-42.
    - Methane (CH4) has a duplicate for 2102004001.

3. The duplicates above created duplicates in the Master table which must also be deleted – meaning that fixing the EF table does not fix this because the way ERG set up the queries the Master table is never emptied or overwritten, only edited.
    - Also, there were duplicate Fluoranthene records for 2103004001 or 2103004002.

4. There are missing emission factors for several GHG pollutants (CO_2 2102004001, 2103004001, 21040*; CH_4 2102004002, 2103004002, 2104004000 through 210401100; N2O 2102004002, 2103004001 and 2103004002, 2104001000, 2104005000 through 2104011000). These omissions are not corrected as GHG emissions are voluntary.

5. For SCC 2102004002 and 2103004002 the emission factor table has emission factors for $PM_{2.5}$-PRI, PM_{10}-PRI, PM CON, NH_3, SO_2 and VOC, but the tool does not calculate all the emissions as listed in yellow below

SCC	SCC Description	CO	NH_3	NO_X	PM_{10}-FIL	PM_{10}-PRI	$PM_{2.5}$-FIL	$PM_{2.5}$-PRI	PM-CON	SO_2	VOC
2102004002	Stationary Fuel Comb /Industrial /Distillate Oil /IC Engines	192.81		895.82	63.03	64.52	59.03	60.51	1.48		
2103004002	Stationary Fuel Comb /Commercial/Institutional /Distillate Oil /IC Engines	35.25		163.79	11.52		11.52				

To correct this, the tools final master table was edited to add the missing pollutant/SCC/county records with throughput and emissions factor using a query. Then the rows were updated with a query to calculate the emission value.

Emission Factors:

The tool estimates CAP, HAP and GHG emissions using emission factors that are based on fuel usage.

Statewide Fuel Usage Estimates:

The Energy Information Administration (EIA) estimates total statewide fuel usage, and that number provides a starting point for nonpoint category activity. From the latest available 2010 EIA data, the initial estimate of total statewide fuel usage by SCC is below:

SCC	Source Classification Code Description	State Consumption	Unit
2102001000	Stationary Fuel Comb /Industrial /Anthracite Coal /Total: All Boiler Types	0	TON
2102002000	Stationary Fuel Comb /Industrial /Bituminous/Subbituminous Coal /Total: All Boiler Types	710,400	TON
2102004001	Stationary Fuel Comb /Industrial /Distillate Oil /Boilers	3,698.80	E3GAL
2102004002	Stationary Fuel Comb /Industrial /Distillate Oil /IC Engines	3,698.80	E3GAL
2102005000	Stationary Fuel Comb /Industrial /Residual Oil /Total: All Boiler Types	966.93	E3GAL
2102006000	Stationary Fuel Comb /Industrial /Natural Gas /Total: Boilers and IC Engines	63,120.16	E6FT3
2102007000	Stationary Fuel Comb /Industrial /Liquified Petroleum Gas /Total: All Boiler Types	15,772.40	E3GAL
2102008000	Stationary Fuel Comb /Industrial /Wood /Total: All Boiler Types	3,424,000	E6BTU
2102011000	Stationary Fuel Comb /Industrial /Kerosene /Total: All Boiler Types	294	E3GAL
2103001000	Stationary Fuel Comb /Commercial/Institutional /Anthracite Coal /Total: All Boiler Types	0	TON
2103002000	Stationary Fuel Comb /Commercial/Institutional /Bituminous/Subbituminous Coal /Total: All Boiler Types	134,125	TON
2103004001	Stationary Fuel Comb /Commercial/Institutional /Distillate Oil /Boilers	674.84	E3GAL
2103004002	Stationary Fuel Comb /Commercial/Institutional /Distillate Oil /IC Engines	674.84	E3GAL
2103005000	Stationary Fuel Comb /Commercial/Institutional /Residual Oil /Total: All Boiler Types	172.66	E3GAL
2103006000	Stationary Fuel Comb /Commercial/Institutional /Natural Gas /Total: Boilers and IC Engines	58922.03	E6FT3
2103007000	Stationary Fuel Comb /Commercial/Institutional /Liquified	4788.18	E3GAL

SCC	Source Classification Code Description	State Consumption	Unit
	Petroleum Gas /Total: All Combustor Types		
2103008000	Stationary Fuel Comb /Commercial/Institutional /Wood /Total: All Boiler Types	3,028,000	E6BTU
2103011000	Stationary Fuel Comb /Commercial/Institutional /Kerosene /Total: All Combustor Types	294	E3GAL
2104001000	Stationary Fuel Comb /Residential /Anthracite Coal /Total: All Combustor Types	0	TON
2104002000	Stationary Fuel Comb /Residential /Bituminous/Subbituminous Coal /Total: All Combustor Types	18,000	TON
2104004000	Stationary Fuel Comb /Residential /Distillate Oil /Total: All Combustor Types	65	E3GAL
2104006000	Stationary Fuel Comb /Residential /Natural Gas /Total: All Combustor Types	107,389	E6FT3
2104007000	Stationary Fuel Comb /Residential /Liquified Petroleum Gas /Total: All Combustor Types	4,870	E3BBL
2104011000	Stationary Fuel Comb /Residential /Kerosene /Total: All Heater Types	32	E3BBL

Non-Fuel Use Adjustment:

Because certain fuels are used as source materials for a final product (petroleum products become fertilizer or plastics products), this amount of fuel is removed from the amount potentially included in nonpoint combustion.

Point Source Subtraction:

Because the EIA fuel usage covers usage by both point and nonpoint facilities, Missouri subtracted the amount of fuel used at the 505 point sources to ensure this fuel use wasn't counted in both the point and nonpoint categories. To do this, point source data was first checked to ensure it was appropriate. Five emission units were changed from a status of "insignificant" or "inactive" back to "active" because they had reported a non-zero throughput and emissions greater than zero. All point source SCCs in Missouri's database are active in the EIS. During the review of individual fuel usage at the facility level, several facilities were noted to be using an incorrect SCC code (institution using an SCC for industrial fuel use SCC, industrial facility using electric fuel usage SCC, etc). These errors were corrected and the revised categorization is described in the following section for each facility type.

The provided crosswalk of point source SCCs was used to determine point source fuel usage by fuel type.

1. Coal (210*001000 and 210*002000): There is no anthracite coal usage in Missouri per the EIA, and emissions for 210*001000 are all zero. Fourteen industrial facilities and three institutional

facilities report bituminous/subbituminous coal usage in 2011. Of those, five of seven kiln operators use coal as a feedstock but do not directly report the tonnage of coal used at the facility (their emission factors are based on the tons of final product produced). Adding up the statewide total tonnage of coal used in each category, the totals are below:

Source type	Number of Facilities	Missouri Reported Coal Usage (tons)	EIA Estimated Coal Usage (tons)
Industrial	14	854,158	710,400
Commercial/Institutional	3 (all universities)	123,684	134,125

Missouri reports more tonnage of coal used in industrial point sources than the EIA estimates is used by all sources, point or nonpoint. This is likely an artifact of differing dataset years – Missouri point source data is 2011-specific and the EIA data is from 2010. All industrial nonpoint coal usage is zeroed out for Missouri.

Commercial/Institutional use is within 10% of each other, and given the year of data discrepancy, it is assumed all C/I coal usage is accounted for in the point source inventory, so nonpoint coal usage is zeroed out.

Residential coal use for heating is zeroed out based on the assumption that these units would be subject to state inspection and/or permitting and none have been identified.

2. Kerosene (210*011000): No industrial kerosene usage is reported by point sources. Only one institutional facility reports kerosene usage as a point source (Whiteman Air Force Base in Johnson County 29101). With a reported usage of 90,000 gal in 2011, the Johnson County point source usage is more than what the method would estimate for county-level nonpoint usage (1,300 gal). Instead of zeroing out the single county kerosene estimate for Johnson County, the 90 thousand gallons of kerosene usage in a single county is subtracted from the state level usage of 294 thousand gallons, and the remaining nonpoint kerosene usage (204 thousand gallons) is distributed throughout the state. No adjustments are made to residential kerosene usage.

3. Residual Oil (210*005000): Two institutional facilities and three industrial facilities report point source residual oil usage in 2011. The two institutional facilities are Northwest Missouri State University (Nodaway County, 29147) and SSM DePaul Health Center (St. Louis County, 29189) with usage of 6.79 and 3.782 thousand gallons respectively. The total commercial/institutional statewide residual oil usage is 172 thousand gallons, so the single counties with point source usage are adjusted. The three industrial sources account for 58 thousand gallons of the statewide usage of 966 thousand gallons, so the three counties with activity (St. Genevieve 29186, Mississippi Lime, 37 thousand gallons; St. Louis City 29510, JW Aluminum, 18.47 thousand gallons; Greene 29077, Carlisle Power Transmission, 3.1 thousand gallons) are adjusted. No adjustments are made to residential residual oil usage.

4. LPG (210*007000): Three institutional and nineteen industrial facilities reported point source LPG usage as listed in the table below. Over half of Missouri's estimated industrial LPG (7,882 thousand gallons of 15,772 thousand gallons) is accounted for in the point source inventory. Each of the nineteen counties with point source fuel usage is adjusted in either the commercial/institutional or industrial category. No adjustments are made to residential LPG usage.

County	Commercial/Institutional Facility Name	Fuel Use (thou gal)
29169		490.94
	INSTALN MGMNT CMND AND FT LEONARD WOOD-FORT LEONARD WOOD	490.94
29189		1.49
	MSD, MISSOURI RIVER WWTP-MO RIVER WASTERWATER TREATMENT PLANT	1.49
29213		23.54
	COLLEGE OF THE OZARKS-BRANSON	23.54
County	**Industrial Facility Name**	**Fuel Use (thou gal)**
29031		178.94
	BUZZI UNICEM USA-CAPE GIRARDEAU	1.94
	NORDENIA U.S.A. INC-NEELY'S LANDING-SITE 1	177.00
29033		10.08
	AGRISERVICES OF BRUNSWICK LLC WEST-BRUNSWICK WEST	10.08
29065		40.00
	ROYAL OAK ENTERPRISES INC-SALEM BRIQUET PLANT	40.00
29071		74.58
	BULL MOOSE TUBE COMPANY-BULL MOOSE TUBE COMPANY	74.58
29091		17.74
	ARMSTRONG HARDWOOD FLOORING COMPANY-WEST PLAINS	17.74
29093		6,716.00
	DOE RUN COMPANY-BUICK SMELTER	6,716.00
29095		391.00
	VANCE BROTHERS INC-BRIGHTON	391.00
29105		0.84
	BRUNSWICK FRESHWATER GROUP-LEBANON MISSOURI FACILITY	0.84
29125		1.16
	KINGSFORD MANUFACTURING CO-BRIQUETTING PLANT	1.16
29133		9.30
	CONSOLIDATED GRAIN AND BARGE CO-DORENA FACILITY	9.30
29143		43.91
	MAHAN GIN CO-MAHAN GIN CO	43.91
29145		1.19
	FAG BEARINGS CORPORATION-JOPLIN	1.19
29175		50.60
	THOMAS HILL ENERGY CENTER POWER DIVISION-THOMAS HILL	50.60
29201		30.80
	CROWDER GIN COMPANY INC-CROWDER	30.80
29207		298.91
	J. P. ROSS COTTON CO INC-J. P. ROSS COTTON CO INC	71.00
	W. W. WOOD PRODUCTS-DUDLEY	227.91
29510		16.95
	SOUTHERN METAL PROCESSING-SOUTHERN METAL PROCESSING	16.53
	ST. LOUIS METALLIZING COMPANY-ST LOUIS	0.42
	Grand Total (Commercial/Institutional and Industrial)	**8,397.97**

5. Wood (210*008000):

Three institutional and fourteen industrial facilities reported point source wood combustion in 2011. These facilities reported a combination of wood throughput units of measure (tons, pounds, BTU) and usage was converted to mmBTU for adjustment of EIA data. Residential wood combustion is covered as a separate category.

		Heat Input (mmbtu)	
County and Total	**Point Source Facility Name**	**Commercial/ Institutional**	**Industrial**
29019		4,142.82	
	UNIVERSITY OF MISSOURI (MU)-POWER PLANT	4,142.82	
29053			5,525.00
	HUEBERT FIBERBOARD INC-BOONVILLE		205,525.00
29065			188,951.00
	ROYAL OAK ENTERPRISES INC-SALEM BRIQUET PLANT		188,951.00
29091			254,018.80
	ARMSTRONG HARDWOOD FLOORING COMPANY		62,108.80
	ROYAL OAK ENTERPRISES INC-WEST PLAINS BRIQUETTE		85,662.00
	SMITH FLOORING COMPANY-MOUNTAIN VIEW		106,248.00
29105			191,348.24
	INDEPENDENT STAVE CO INC-LEBANON PLANT		191,348.24
29107			2,491.84
	REMINGTON ARMS-REMINGTON ARMS, BLDG #1		2,491.84
29147		127,890.93	
	NORTHWEST MISSOURI STATE UNIVERSITY	127,890.93	
29157			18,179.20
	ATLAS EPS-PERRYVILLE		18,179.20
29161		95,404.50	
	MISSOURI UNIV. OF SCIENCE AND TECHNOLOGY	95,404.50	
29201			225,493.34
	HAVCO WOOD PRODUCTS INC		225,493.34
29203			25,961.73
	HARDWOODS OF MISSOURI LLC-BIRCH TREE		25,961.73
29207			16,945.34
	AMES TRUE TEMPER INC-BERNIE NORTH PLANT		16,945.34
29213			68,276.00
	ROYAL OAK ENTERPRISES-ROYAL OAK		

		Heat Input (mmbtu)	
County and Total	**Point Source Facility Name**	**Commercial/ Institutional**	**Industrial**
	ENTERPRISES		68,276.00
29215			3,046.33
	WOODPRO CABINETRY INC-CABOOL		3,046.33
29510			1,277.12
	ANHEUSER-BUSCH INC-ST. LOUIS		1,277.12
Grand Total		**227,438.25**	**1,201,513.94**

6. Natural Gas (210*006000):
   Fifty commercial/institutional and 218 industrial facilities reported point source natural gas usage in 2011. The number of facilities and total gas (in mmcf) used in 2011 is summarized to the county level below. No adjustment is made to residential natural gas usage.

	Commercial/Institutional		Industrial	
County	Number of Facilities	Heat Input (mmcf)	Number of Facilities	Heat Input (mmcf)
29007			6	877.11
29009			5	735.95
29017			1	1,291.95
29019	4	75.39	5	1,557.42
29021	1	124.83	9	1,317.80
29023			5	376.32
29027	2	7.80	2	137.03
29031	2	111.07	3	1,413.71
29037			1	37.90
29039			2	254.05
29045			1	8.82
29047	1	149.95	13	2,451.53
29051			2	153.98
29053	1	60.06	3	38.33

	Commercial/Institutional		Industrial	
County	Number of Facilities	Heat Input (mmcf)	Number of Facilities	Heat Input (mmcf)
29069			4	19.58
29071			8	92.69
29073			1	36.94
29077	3	420.00	6	796.79
29079			1	76.35
29083			3	50.96
29087			2	74.64
29091			2	53.45
29095	6	1,644.31	12	3,420.53
29097	3	64.79	7	609.79
29099			7	6,143.30
29101	3	396.60	1	84.12
29105			3	16.22
29107			1	122.94
29109			1	96.66

	Commercial/Institutional		Industrial	
County	Number of Facilities	Heat Input (mmcf)	Number of Facilities	Heat Input (mmcf)
29113			2	77.80
29115			1	7.58
29117			1	1.11
29119			1	1,286.92
29121			1	440.05
29123			1	118.81
29127			1	537.38
29133			1	20.97
29143			2	718.34
29145			4	75.31
29147	1	7.78	3	895.56
29155	1	81.00	3	90.78
29157			2	84.15
29159			7	2,497.04
29161			1	0.72

	Commercial/Institutional		Industrial	
County	Number of Facilities	Heat Input (mmcf)	Number of Facilities	Heat Input (mmcf)
29163			3	111.57
29165	2	216.56	2	124.03
29169	1	634.41		
29183	2	128.48	8	502.16
29186			2	115.07
29187			2	433.31
29189	6	969.57	15	2,019.31
29195			2	1,599.82
29201			3	196.35
29205			1	85.85
29207			2	915.80
29213	1	101.34		
29215			1	155.89
29217			2	762.29
29219			1	2.20

	Commercial/Institutional		Industrial	
County	Number of Facilities	Heat Input (mmcf)	Number of Facilities	Heat Input (mmcf)
29221			2	76.79
29225			2	18.63
29229			1	26.48
29510	10	1,700.22	21	3,106.54
Grand Total	**50**	**6,894.16**	**218**	**39,451.43**

7. Diesel/Distillate (210*00400*):

Nineteen commercial/institutional and 61 industrial facilities reported point source diesel usage in 2011. The list of facilities and their usage in thousand gallons are listed in the following table. The individual county fuel usage is adjusted by these amounts which are divided in half to apply equal portions to the boiler and I/C engine SCCs. No adjustment is made to residential diesel usage.

		Diesel Usage (thousand gallons)	
County and Total	Facility Name	Commercial/ Institutional	Industrial
29007			0.02
	AMEREN MISSOURI-AUDRAIN POWER STATION		0.02
29013			8.82
	BUTLER MUNICIPAL POWER PLANT-BUTLER		8.82
29019		21.47	0.54
	CHRISTIAN HEALTH SYSTEMS-BOONE HOSPITAL CENTER	21.00	
	COLUMBIA ENERGY CENTER-PEABODY ROAD		0.54
	UNIVERSITY OF MISSOURI (MU)-POWER PLANT	0.47	
29021		2.41	2.10
	ALTEC INDUSTRIES INC-ST. JOSEPH		2.10
	HEARTLAND REGIONAL MEDICAL CENTER EAST-ST. JOSEPH	2.41	
29027			312.02
	AMEREN MISSOURI-CALLAWAY NUCLEAR POWER PLANT		312.02
29031			9.09
	JACKSON MUNICIPAL UTILITIES-JACKSON		6.14
	PROCTER & GAMBLE PAPER PRODUCTS CO-NEELY'S LANDING		2.95
29045			0.94
	KAHOKA ELECTRIC GENERATING PLANT		0.94
29047			44.25
	FORD MOTOR CO-KANSAS CITY ASSEMBLY PLANT		0.80
	INDEPENDENCE POWER AND LIGHT-MISSOURI CITY STATION		43.45
29053		1.80	

		Diesel Usage (thousand gallons)	
County and Total	Facility Name	Commercial/ Institutional	Industrial
	OFFICE OF ADMINISTRATION FMDC	1.80	
29071			1.59
	AMEREN MISSOURI-LABADIE PLANT		1.59
29077			2.17
	3M COMPANY-SPRINGFIELD ITSD/TMD		0.50
	ARCHIMICA INC-SPRINGFIELD		0.43
	CITY UTILITIES OF SPRINGFIELD MISSOURI-JAMES RIVER		0.15
	CITY UTILITIES OF SPRINGFIELD MISSOURI-JOHN TWITTY		0.26
	CITY UTILITIES OF SPRINGFIELD-FULBRIGHT WATER		0.73
	DAIRY FARMERS OF AMERICA INC-SPRINGFIELD		0.10
29079			8.83
	TRENTON MUNICIPAL UTILITIES-TRENTON PEAKING PLANT		8.83
29083			7.70
	APAC MO, INC-TIGHTWAD (LEESVILLE) QUARRY		7.70
29095		36.03	73.77
	ALLIANT TECHSYSTEMS INC-LAKE CITY		0.98
	BARBER & SONS AGGREGATES-LEES SUMMIT		46.66
	BAYER CROPSCIENCE-KANSAS CITY		26.13
	CROWN CENTER REDEVELOPMENT CORPORATION	1.25	
	RESEARCH MEDICAL CENTER-MIDWEST DIVISION-RMC, LLC	0.78	
	U. S. DEPT OF ENERGY-KANSAS CITY PLANT (NNSA)	34.00	
29097			0.14

		Diesel Usage (thousand gallons)	
County and Total	Facility Name	Commercial/ Institutional	Industrial
	EBV EXPLOSIVES ENVIRONMENTAL CO-JOPLIN		0.14
29099			1.57
	AMEREN MISSOURI-RUSH ISLAND PLANT		1.45
	METAL CONTAINER CORPORATION-ARNOLD		0.12
29101		11.96	0.09
	HOLDEN POWER PLANT-HOLDEN		0.09
	WHITEMAN AIR FORCE BASE-WHITEMAN	11.96	
29107			6.67
	HIGGINSVILLE MUNICIPAL POWER FACILITY		6.67
29109			0.48
	BCP INGREDIENTS-VERONA PLANT		0.48
29113			0.31
	BODINE ALUMINUM INC-TROY		0.31
29115			0.80
	MARCELINE MUNICIPAL UTILITY		0.80
29117			13.98
	CHILLICOTHE MUNICIPAL UTILITIES-CHILLICOTHE		13.98
29119			35.56
	WAL-MART NORTH DATA CENTER-PINEVILLE		35.56
29125			361.82
	KINGSFORD MANUFACTURING CO-BRIQUETTING PLANT		361.82
29143			15.92
	BUNGE NORTH AMERICA INC-LINDA ELEVATOR		15.00
	NEW MADRID POWER PLANT-MARSTON		0.92
29145			0.12
	LA-Z-BOY, INCORPORATED-LA-Z-BOY MIDWEST		0.12
29147			0.02
	ENERGIZER BATTERY MANUFACTURING INC-MARYVILLE PLANT		0.02
29151			1.03
	CENTRAL ELECTRIC POWER COOPERATIVE-CHAMOIS PLANT		1.03
29159			0.07
	PITTSBURGH-CORNING CORP-SEDALIA		0.07
29161			12.30
	ROLLA MUNICIPAL UTILITIES-MULTIPLE PEAKING PLANTS		12.30
29163			85.89
	ASHLAND INC-MISSOURI CHEMICAL WORKS		85.84
	WAYNE B SMITH INC-LOUISIANA		0.05
29165		9.29	
	KCI AIRPORT - KCMO AVIATION DEPT-KCI AIRPORT	9.29	
29169		44.48	
	INSTALN MGMNT CMND AND FT LEONARD WOOD	44.48	
29175			73.43
	THOMAS HILL ENERGY CENTER POWER DIVISION		73.43
29183		4.57	183.67
	AMEREN MISSOURI-SIOUX PLANT		177.41
	MEMC ELECTRONIC MATERIALS INC-ST. PETERS PLANT		6.26

County and Total	Facility Name	Diesel Usage (thousand gallons) Commercial/ Institutional	Industrial
	ST. JOSEPH HEALTH CENTER-ST. JOSEPH HEALTH CENTER	4.57	
29187			51.88
	LEAD BELT MATERIALS CO INC-BONNE TERRE		9.78
	LEAD BELT MATERIALS CO INC-PARK HILLS		12.89
	VALLEY MINERALS, LLC-BONNE TERRE		29.21
29189		44.98	69.95
	AMEREN MISSOURI-MERAMEC PLANT		0.39
	MONSANTO WORLD HEADQUARTERS-LINDBERGH BLVD		30.64
	MONSANTO-CHESTERFIELD VILLAGE		29.74
	REICHHOLD, INC-VALLEY PARK		0.42
	ROCKWOOD PIGMENTS NA INC-E HOFFMEISTER		0.78
	ST. LOUIS AIRPORT AUTHORITY-LAMBERT INTERNATIONAL	19.15	
	ST. LUKE'S HOSPITAL-WOODS MILL ROAD	13.01	
	ST. MARYS HEALTH CENTER-RICHMOND HEIGHTS	0.53	
	THE BOEING COMPANY-ST. LOUIS		7.98
	WASHINGTON UNIVERSITY-DANFORTH CAMPUS	12.29	
29195			5.15
	MARSHALL MUNICIPAL UTILITIES		5.15
29205			14.20
	SHELBINA POWER PLANT-SHELBINA POWER PLANT		14.20
29213		30.00	25.07
	COLLEGE OF THE OZARKS-BRANSON	30.00	
	TABLE ROCK ASPHALT CONSTR CO INC-HWY 248 QUARRY		25.07
29217			1.44
	3M COMPANY-NEVADA - COMMERCIAL GRAPHICS		1.44
29510		58.35	32.10
	BARNES JEWISH HOSPITAL-ST LOUIS	24.60	
	MALLINCKRODT INC-N SECOND		17.22
	PROCTER AND GAMBLE-ST. LOUIS		3.79
	SOUTHERN METAL PROCESSING		11.09
	TRIGEN-ST. LOUIS ENERGY CORP-ASHLEY STREET STATION	3.84	
	WASHINGTON UNIV MEDICAL SCHOOL-BOILER PLANT	29.91	
Grand Total		**265.33**	**1,465.49**

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Emission Totals:

The final statewide nonpoint ICI and residential emissions submitted to the 2011 NEI are as follows:

SCC	SCC Description	CO	NH_3	NO_X	PM_{10} FIL	PM_{10} PRI	$PM_{2.5}$ FIL	$PM_{2.5}$ PRI	PM CON	SO_2	VOC
2102001000	Stationary Fuel Comb /Industrial /Anthracite Coal /Total: All Boiler Types	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2102002000	Stationary Fuel Comb /Industrial /Bituminous/Subbituminous Coal /Total: All Boiler Types	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2102004001	Stationary Fuel Comb /Industrial /Distillate Oil /Boilers	7.42	1.19	29.66	1.48	3.41	0.37	2.30	1.93	63.18	0.30
2102004002	Stationary Fuel Comb /Industrial /Distillate Oil /IC Engines	192.81	0.12	895.82	63.03	64.52	59.03	60.51	1.48	59.03	0.30
2102005000	Stationary Fuel Comb /Industrial /Residual Oil /Total: All Boiler Types	2.27	0.36	24.98	9.41	10.09	6.13	6.81	0.68	160.43	0.13
2102006000	Stationary Fuel Comb /Industrial /Natural Gas /Total: Boilers and IC Engines	994.10	37.87	1,183.46	2.37	6.39	1.30	5.09	3.79	7.10	65.09

SCC	SCC Description	CO	NH_3	NO_X	PM_{10} FIL	PM_{10} PRI	$PM_{2.5}$ FIL	$PM_{2.5}$ PRI	PM CON	SO_2	VOC
2102007000	Stationary Fuel Comb /Industrial /Liquified Petroleum Gas /Total: All Boiler Types	31.44	1.18	56.14	0.08	0.20	0.04	0.16	0.12	0.24	2.05
2102008000	Stationary Fuel Comb /Industrial /Wood /Total: All Boiler Types	666.75	7.78	244.47	555.62	574.51	477.83	496.73	18.89	27.78	18.89
2102011000	Stationary Fuel Comb /Industrial /Kerosene /Total: All Boiler Types	0.71	0.11	2.84	0.14	0.32	0.04	0.22	0.18	6.26	0.03
2103001000	Stationary Fuel Comb /Commercial/Institutional /Anthracite Coal /Total: All Boiler Types	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2103002000	Stationary Fuel Comb /Commercial/Institutional /Bituminous/Subbituminous Coal /Total: All Boiler Types	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SCC	SCC Description	CO	NH_3	NO_X	PM_{10} FIL	PM_{10} PRI	$PM_{2.5}$ FIL	$PM_{2.5}$ PRI	PM CON	SO_2	VOC
2103004001	Stationary Fuel Comb /Commercial/Institutional /Distillate Oil /Boilers	1.36	0.22	5.42	0.29	0.65	0.23	0.58	0.35	11.55	0.09
2103004002	Stationary Fuel Comb /Commercial/Institutional /Distillate Oil /IC Engines	35.25	0.02	163.79	11.52	11.80	11.52	11.80	0.27	10.79	0.09
2103005000	Stationary Fuel Comb /Commercial/Institutional /Residual Oil /Total: All Boiler Types	0.41	0.06	4.46	1.21	1.33	0.45	0.57	0.12	28.66	0.09
2103006000	Stationary Fuel Comb /Commercial/Institutional /Natural Gas /Total: Boilers and IC Engines	2,185.18	12.75	2,601.40	5.20	13.53	2.86	11.19	8.32	15.61	143.08
2103007000	Stationary Fuel Comb /Commercial/Institutional /Liquified Petroleum Gas /Total: All Combustor Types	17.03	0.11	30.41	0.04	0.11	0.02	0.09	0.06	0.13	1.11

SCC	SCC Description	CO	NH_3	NO_X	PM_{10} FIL	PM_{10} PRI	$PM_{2.5}$ FIL	$PM_{2.5}$ PRI	PM CON	SO_2	VOC
2103008000	Stationary Fuel Comb /Commercial/Institutional /Wood /Total: All Boiler Types	840.17	7.00	308.06	700.14	723.95	602.12	625.93	23.80	35.01	23.80
2103011000	Stationary Fuel Comb /Commercial/Institutional /Kerosene /Total: All Combustor Types	0.49	0.08	1.97	0.11	0.24	0.08	0.21	0.13	4.35	0.03
2104001000	Stationary Fuel Comb /Residential /Anthracite Coal /Total: All Combustor Types	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2104002000	Stationary Fuel Comb /Residential /Bituminous/Subbituminous Coal /Total: All Combustor Types	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2104004000	Stationary Fuel Comb /Residential /Distillate Oil /Total: All Combustor Types	3.41	0.68	12.29	0.74	1.62	0.57	1.45	0.89	29.07	0.48
2104005000	Stationary Fuel Comb /Residential /Residual Oil /Total: All Combustor Types	0	0	0	0	0	0	0	0	0	

SCC	SCC Description	CO	NH_3	NO_X	PM_{10} FIL	PM_{10} PRI	$PM_{2.5}$ FIL	$PM_{2.5}$ PRI	PM CON	SO_2	VOC
2104006000	Stationary Fuel Comb /Residential /Natural Gas /Total: All Combustor Types	2,147.78	1,073.89	5,047.28	10.74	27.92	5.91	23.09	17.18	32.22	295.32
2104007000	Stationary Fuel Comb /Residential /Liquified Petroleum Gas /Total: All Combustor Types	388.63	4.75	1,370.42	1.94	5.04	1.07	4.17	3.10	5.82	53.35
2104011000	Stationary Fuel Comb /Residential /Kerosene /Total: All Heater Types	3.24	0.65	11.66	0.70	1.54	0.54	1.38	0.84	27.60	0.45

QA of Data Created by Tool:

Number of Records: There are 115 counties in Missouri, and 115 location data records. With 25 SCC's per county and 115 counties, there are 2,875 records in the reporting period and emission process tables. With between 13 and 62 pollutants per SCC, there are 97,865 records in the emissions table submitted to the EIS.

The master data table didn't populate the TotalEmissions or activity fields for SCC 2104005000 (Residential Residual Oil) since nonpoint activity was zero. These fields were updated in the master table and EIS staging table.

Appendix B-4

2011 Oil and Gas Inventory Enhancement Project for CenSARA States

2011 Oil and Gas Emission Inventory Enhancement Project for CenSARA States

Prepared for:
CENTRAL STATES AIR RESOURCES AGENCIES (CenSARA)
P.O. Box 617
Oklahoma City, OK 73101

Prepared by:
ENVIRON International Corporation
773 San Marin Drive, Suite 2115
Novato, California, 94945
www.environcorp.com
P-415-899-0700
F-415-899-0707

Eastern Research Group, Inc.
1600 Perimeter Park Drive, Suite 200
Morrisville, NC 27560
www.erg.com
P-919 468-7800
F-919-468-7801

December 21, 2012

Disclaimer: The data, type and level of controls, and emission limits in this final report and accompanying tool should be considered preliminary and under review by the states. In addition, emission and control factors applied in this work may not reflect lower emission limits specified in state regulations for ozone non-attainment areas and certain attainment areas influencing non-attainment areas. For final 2011 NEI data or for information relating to modified emission and control factors, please contact the individual state.

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1.0 EXECUTIVE SUMMARY

The Central States Air Resource Agencies (CenSARA) has identified the need to improve the activity data and methodologies used by its member states to develop oil and gas area source emissions. CenSARA states, including Texas, Louisiana, Oklahoma, Arkansas, Kansas, Missouri and Nebraska need to develop 2011 area source inventories of criteria pollutants (CO, SO_2, NOx, VOCs, PM), selected hazardous air pollutants (HAPs), hydrogen sulfide and methane to be included in their submission to the 2011 National Emissions Inventory (NEI). ENVIRON and the Eastern Research Group (ERG) reviewed the available data sources and collected basin-level specific emissions information for calendar year 2011 through industry surveys to operators within the CenSARA domain. A map of the oil and gas basins within the CenSARA domain is shown in Figure E-1. As part of this Project, an Emissions Calculator Tool was developed which facilitates calculations of emission estimates for calendar year 2011 and enables each CenSARA state to generate oil and gas area source emissions estimates and to format these emissions in an EIS-ready format for future NEI submissions.

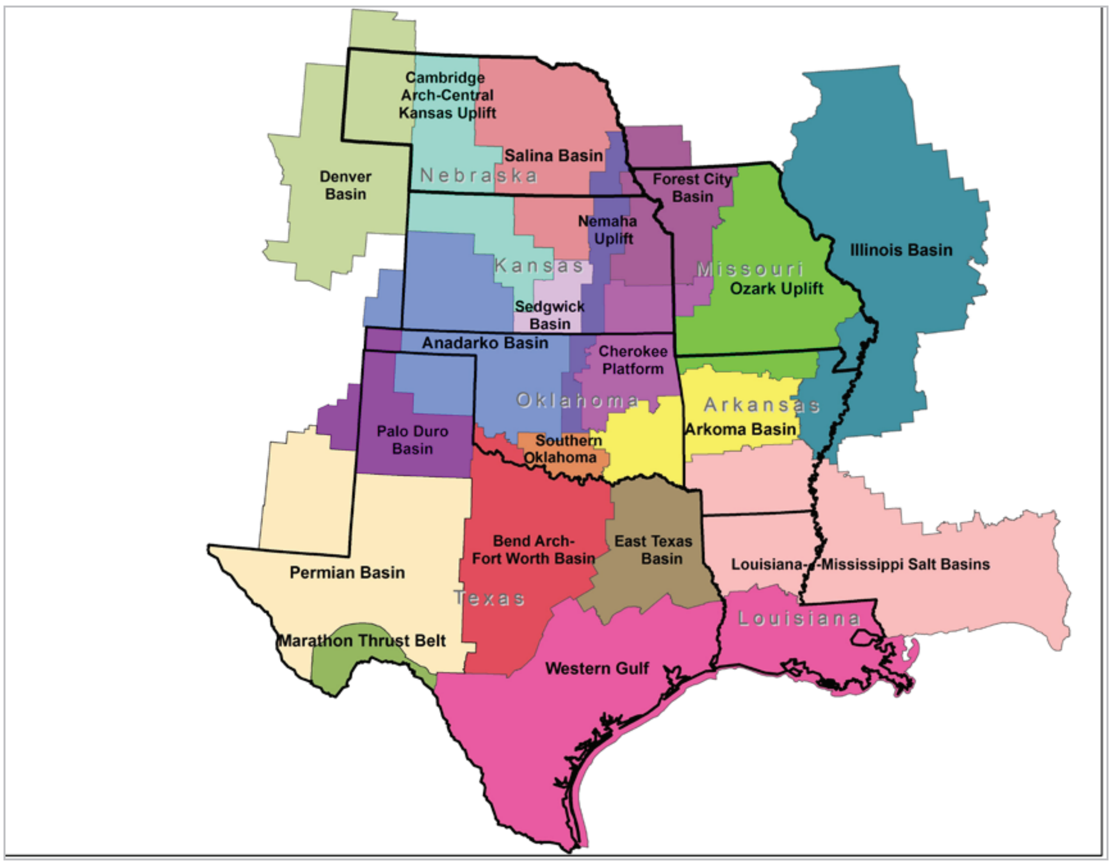

Figure E-1. Oil and gas basins in the CenSARA domain.

The following specific tasks were pursued as part of this goal:

- Oil and gas production activity levels throughout the CenSARA region including, but not limited to, the number of active wells by well type, gas production and oil production, spud

counts[1], feet drilled, and water production were updated for 2011 using the HPDI "DI Desktop" database, a commercial database that processes state-level oil and gas commission data into a comprehensive database of production statistics.

- Basin-level data on equipment, activity and emissions factors were developed or collected for estimating 2011 emissions from a variety of resources including 1) oil and gas operator surveys, 2) state minor source permit applications, and 3) literature review.
- An Emissions Calculator Tool that estimates 2011 oil and gas area source emissions at the basin and county level was developed: estimates are compiled within a worksheet tool, documented in this report, which enables CenSARA members to update activity and emissions data at the basin and/or county level for future use. The tool is based on the existing emissions calculator developed by ERG for Texas (ERG, 2010) but expanded to include inventory enhancements performed in the current study.
- A database program was developed to automatically convert the emissions estimated by the Calculator Tool into an EIS-ready format to facilitate NEI submissions. Data stored in the EIS staging tables can be converted into valid XML files that are in compliance with the CERS using an EPA-supplied XML File Generator tool. This program and the emissions calculator provide the necessary set of tools for CenSARA members to both generate the oil and gas emissions and format them for NEI submission.

The CenSARA domain represents a substantial percentage of the onshore oil and gas production in the continental United States. In 2010, seven CenSARA oil and gas producing states (Texas, Oklahoma, Louisiana, Arkansas, Kansas, Nebraska and Missouri) had a combined oil production of approximately 611 million barrels and a combined gas production of 12.8 trillion cubic feet (EIA, 2012), representing 48 % of total gas production and 31% of total oil production in the country. Key production statistics are shown in Table E-1. Production statistics obtained from the HPDI database were used as scaling surrogates for estimating oil and gas area source emissions at the county level.

Table E-1. Key production statistics for basins in the CenSARA domain (HPDI, 2012).

	2011 Statistics			
Basin	Crude Oil Production (1000 bbl/yr)	Condensate Production (1000 bbl/yr)	Natural Gas Production (BCF/yr)	Spud Count
Anadarko Basin	38,850	23,404	1,668	1,484
Arkoma Basin	1,210	106	1,567	952
Bend Arch-Fort Worth Basin	27,124	3,712	2,088	1,534
Cambridge Arch-Central Kansas Uplift	17,441	939	11	843
Cherokee Platform	9,222	782	104	876
Denver Basin	393	751	1	6
East Texas Basin	15,403	6,062	1,839	629
Forest City Basin	1,329	18	0	773
Illinois Basin	0	0	3	0

[1] Spud refers to the process of beginning to drill a well. A spud count is the number of wells that commenced drilling over a particular period of time.

Basin	2011 Statistics			
	Crude Oil Production (1000 bbl/yr)	Condensate Production (1000 bbl/yr)	Natural Gas Production (BCF/yr)	Spud Count
Louisiana-Mississippi Salt Basins	14,781	2,151	2,506	707
Marathon Thrust Belt	4	82	42	8
Nemaha Uplift	4,620	1,078	23	133
Ozark Uplift	0	0	0	0
Palo Duro Basin	3,562	82	19	19
Permian Basin	299,041	5,683	529	2,201
Salina Basin	273	8	0	22
Sedgwick Basin	3,063	1,523	37	257
Southern Oklahoma	9,377	1,931	78	19
Western Gulf	144,930	61,147	2,102	1,671
CenSARA Region Total	**590,621**	**109,459**	**12,615**	**12,134**

The number of active wells by well type is another key indicator of the oil and gas activity in the CenSARA region. Active well counts from the HPDI database for each basin within CenSARA are shown in Figure E-2.

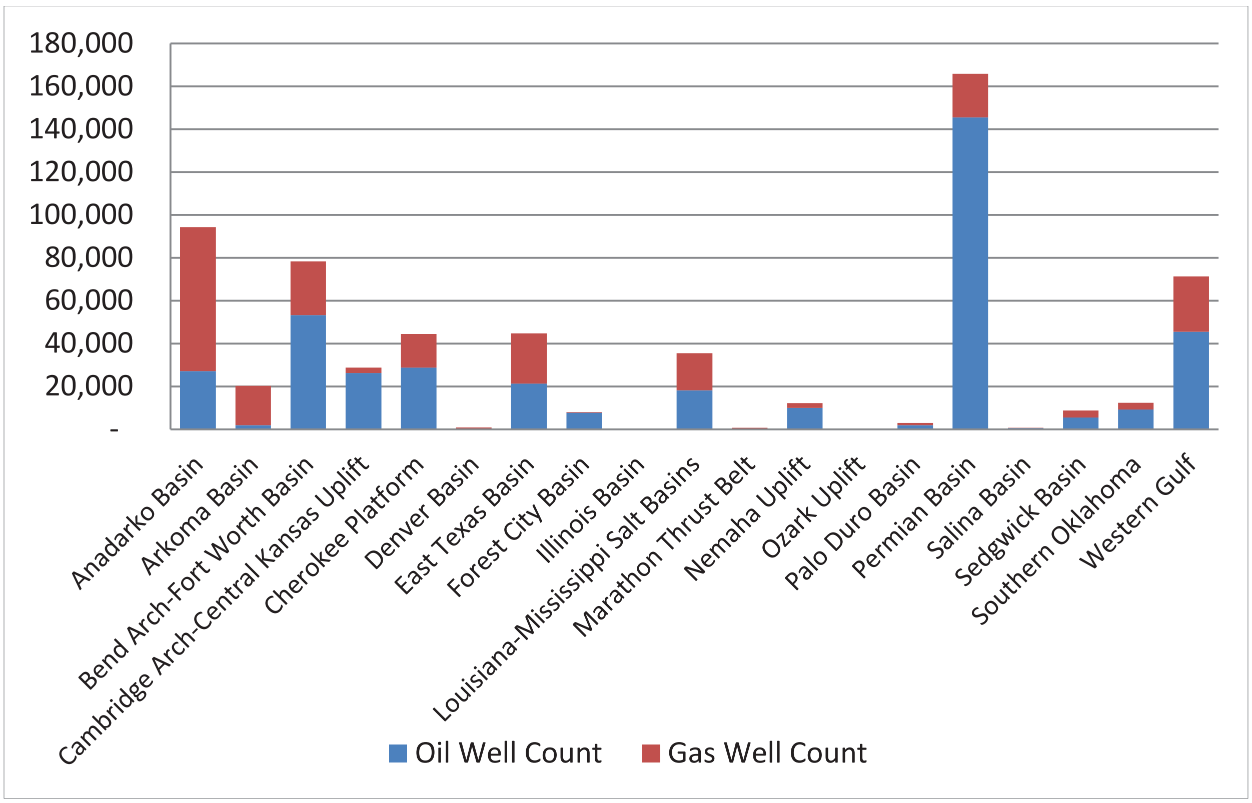

Figure E-2. Active well counts by well type for each basin in CenSARA (HPDI, 2012).

With the use of the Emissions Calculator Tools developed for this project, 2011 oil and gas area source emissions inventories were prepared for each oil and gas producing State within the CenSARA region. These inventories are highly detailed in their geographical specificity by including emissions at basin, state and county levels, in the array of pollutants included (16 total), and in the array of source categories analyzed. Source categories included in the inventory are:

- Artificial Lift Engines
- Wellhead Compressor Engines
- Lateral Compressor Engines
- Drilling Rigs
- Condensate Tanks
- Hydraulic Fracturing Pumps
- Well Completion Venting
- Blowdown Venting
- Casing Gas Venting
- Dehydrators
- Pneumatic Devices
- Heaters
- Crude Oil Tanks
- Produced Water Tanks
- Gas-Actuated Pneumatic Pumps
- Fugitive Emissions
- Mud Degassing
- Hydrocarbon Liquids Loading
- Flaring

Table E-2 shows a summary of resulting basin-wide emissions for 2011 from the oil and gas area source inventories developed here. This table only includes emissions for key pollutants of relevancy for air quality issues in the CenSARA domain. Emissions by source category are too extensive to include here but may be found in other sections of the report.

Table E-2. 2011 Basin-wide Emissions for the CenSARA 2011 Oil and Gas Area Source Inventory.

Basin	NOX (TPY)	VOCs (TPY)	CH4 (TPY)
Anadarko Basin	108,952	273,066	708,483
Arkoma Basin	15,615	16,274	294,226
Bend Arch-Fort Worth Basin	144,032	147,646	458,542
Cambridge Arch-Central Kansas Uplift	9,340	39,794	86,424
Cherokee Platform	36,316	73,951	240,037
Denver Basin	1,547	7,693	11,984
East Texas Basin	128,840	100,632	364,708

Basin	NOX (TPY)	VOCs (TPY)	CH4 (TPY)
Forest City Basin	4,345	8,186	19,015
Illinois Basin	15	16	373
Louisiana-Mississippi Salt Basins	39,832	40,341	158,601
Marathon Thrust Belt	3,863	4,525	13,173
Nemaha Uplift	9,081	22,702	43,783
Ozark Uplift	0	0	0
Palo Duro Basin	5,879	6,570	17,978
Permian Basin	166,429	386,201	626,542
Salina Basin	82	610	995
Sedgwick Basin	11,948	25,364	41,127
Southern Oklahoma	7,491	30,292	56,054
Western Gulf	142,582	433,119	566,775
Grand Total CenSARA	**836,191**	**1,616,982**	**3,708,820**

Review of the oil and gas area source emissions by source category suggests that NOx emissions are largely dominated by wellhead compressor emissions, particularly in basins with a large number of active gas wells. Other significant sources of NOx include lateral compressors, drilling rigs, and well-site heaters. Pneumatic devices are the most significant source of VOC and methane emissions in most basins within the CenSARA region. In basins where significant production of condensate and crude oil occurs (for example the Permian and Western Gulf Basins), VOC emissions are dominated by condensate tank and crude oil tank losses. Other key sources of VOC and methane emission include well blowdowns, well-site fugitives and wellhead compressor engines.

2.0 INTRODUCTION

The Central States Air Resource Agencies (CenSARA) is a regional organization that supports the discussion of air quality issues between its members and other interested parties, and aids in identifying options for air pollution control through air quality statutes and regulations. CenSARA oil and gas producing states, which include Texas, Oklahoma, Louisiana, Arkansas, Kansas, Nebraska and Missouri, have determined that significant area source emissions of criteria pollutants (NOx, CO, SO_2, VOCs) and greenhouse gases (GHGs) may be associated with exploration and production activities in the upstream oil and gas sector. Oil and gas production in the remaining two CenSARA states (Iowa and Minnesota) is negligible. Over the last decade, oil and gas exploration and production in the United States has grown significantly, primarily in the Rocky Mountain states, southern Central states, the Gulf of Mexico, and most recently in the Marcellus Shale in the Northeastern U.S. This is partly related to an increased production of unconventional oil and gas resources such as shale gas, produced in formations such as the Fayetteville Shale in Arkansas, Barnett Shale in Texas and Haynesville Shale in Louisiana. In 2010, seven CenSARA states (Texas, Oklahoma, Louisiana, Arkansas, Kansas, Nebraska and Missouri) had a combined oil production of approximately 611 million barrels and a combined gas production of 12.8 trillion cubic feet (EIA, 2012), representing 48 % of total gas production and 31% of total oil production in the United States. Sources of emissions in the upstream oil and gas sector include equipment and processes used in drilling, completion and production activities that are primarily located at or near well sites in active oil and gas fields. These non-point emissions sources are generally not monitored under major source permitting programs and may or may not be subject to minor source permits, making it difficult for states to identify and quantify their emissions and evaluate their collective air quality impacts. Hence, area source emissions from the upstream sector remain a source of concern for CenSARA.

CenSARA sponsored this study to enhance available data and methodologies used by its member states to develop oil and gas area source emissions by reviewing and synthesizing available data and collecting additional data via oil and gas industry surveys. CenSARA states need to develop a 2011 area source inventory for criteria pollutants (CO, SO_2, NOx, VOCs, PM), selected hazardous air pollutants (HAPs[2]), hydrogen sulfide and methane to be included with other emissions inventories submitted to the 2011 National Emissions Inventory (NEI). To achieve this, CenSARA contracted ENVIRON and subcontractor Eastern Research Group (ERG) to research the available data sources and collect updated and basin-wide specific emissions information for upstream oil and gas sources throughout the CenSARA region. In addition, an Emissions Calculator Tool was developed as part of this project that facilitates calculation of calendar year 2011 emission estimates and will enable each CenSARA state to more easily generate emissions estimates for future inventories and NEI submissions.

[2] Targeted HAPS include key VOC species – toluene, xylene, formaldehyde, benzene, ethylbenzene, and n-hexane.

2.1 CENRAP Oil and Gas Emission Inventory

This study builds off the work performed by ENVIRON in 2008 for the Central Regional Air Planning Association (CENRAP). The CENRAP study was an oil and gas emissions inventory enhancement project for the CENRAP region, including Louisiana, Texas, Oklahoma, Arkansas, Kansas and Nebraska (Bar-Ilan, et al., 2008). The main objective of the CENRAP study was to develop recommendations for input data and detailed methodologies to improve CENRAP's oil and gas area source inventories for the base year 2002 and to develop future year projections for calendar year 2018. The study included estimation of nitrogen oxides (NOx), volatile organic compounds (VOC), particulate matter (PM_{10}), carbon monoxide (CO), sulfur dioxide (SO_2) and other pollutants from oil and gas operations. The CENRAP study represented an initial and important step towards providing CENRAP states with a means of developing their own estimates of oil and gas area source emissions. However, the study had certain limitations such as:

- Limited Survey Participation: a limited survey outreach was performed in the study which attempted to gather emissions and activity data for upstream source categories from nine (9) major oil and gas producers in the CENRAP region. Even though participating companies covered a wide geographic range of activities and ownership of production in the CENRAP domain, participation was very limited; only four companies returned surveys with sufficient and useful data.
- Lack of an Emissions Inventory: The CENRAP study was an inventory-enhancement project aimed to provide technical guidance and a set of inputs for CENRAP members to independently estimate emissions for oil and gas area sources within their jurisdiction. The scope of the work did not include development of emission inventories for the base year or the future year.
- Scope of Emissions Sources: some oil and gas source categories, including produced water (evaporative ponds, water tanks), drilling mud degassing and hydraulic fracturing engines have often not been included in area source inventories, generally due to lack of information to characterize their emissions. The current study expands the list of sources that were analyzed in CENRAP by now including: hydraulic fracturing pumps, casing gas venting, produced water tanks, gas-actuated pneumatic pumps, fugitive emissions from compressor seals, mud degassing, and hydrocarbon liquids loading.
- Use of State-by-State Databases for Production Statistics: the CENRAP study relied on each state's oil and gas conservation commission (OGCC) or equivalent agency's database to obtain drilling and production statistics used to scale emissions on a basin-wide level. This required the combination of data from individual states' OGCC databases which may not all have a similar organizational structure. Databases can vary greatly in terms of format, the level of detail of the information tracked by each OGCC, and ultimately the availability of key statistics such as oil production, gas production, active well counts, spud counts, and water production. These inconsistencies impacted the CENRAP study in that it was not possible to consistently incorporate low-level statistics such well counts by type, separate condensate production and crude oil production estimates, and separate natural gas production and casing gas production in all cases.

- Use of State Permit Data: Minor source permit applications can be a resource of geographic-specific activity and emissions data for area source emissions inventories. Several states have minor source permitting programs that require an air permit for oil and gas production facilities (well sites) to operate. These permit applications contain detailed emissions calculations that characterize many upstream oil and gas area sources, and they can be a useful source of field-type data for regional emissions inventories. The CENRAP study did not research minor permit applications to gap-fill data that could not be retrieved by industry surveys and literature reviews. The current work takes advantage of this resource.

2.2 Literature Sources

Recent studies have become available that contain useful information for estimating emissions from oil and gas area sources including information from recent years and/or regions of interest to the CenSARA oil and gas emissions inventory. Some of the studies and reports reviewed here are:

Recommendations for Improvements to the CENRAP States' Oil and Gas Emissions Inventories (Bar-Ilan, et al., 2008): As discussed earlier, the CENRAP work included recommendations for input data and detailed methodologies to improve oil and gas area source inventories within the CENRAP region for year 2002. During the development of emissions inventories in this work for selected source categories, the CENRAP study was found to be the most up-to-date and regionally-specific source of input data available in the literature for the CenSARA domain. This was especially true for some particular categories such as fugitives and heaters that were not included in the industry surveys.

Haynesville Shale 2011 Emissions Inventory Update (ENVIRON, 2012): This study is an update for calendar year 2011 of a previous comprehensive inventory of ozone precursor emissions (VOC, NOx, and CO) from natural gas exploration and production activities in the Haynesville Shale formation, covering its extent in Louisiana and Texas. The updated Haynesville Shale inventory is currently in its draft form at the time of the preparation of this report. The original study (ENVIRON, 2009) developed emissions for a base year 2009 and future annual projections from 2010 to 2020. Source categories included in the inventory range from exploration and production phase to downstream sources; emissions sources reviewed included: drill rigs, hydraulic fracturing, completion venting, well blowdowns, fugitives, pneumatic devices, heaters, dehydrators, flaring, wellhead compressors, compressor stations and gas processing plants. In the latest study (ENVIRON, 2012) detailed activity and emissions data on equipment, processes, well configuration, emissions factors, and usage were updated with data obtained through industry surveys to reflect activity for Haynesville Shale wells in 2011. The current oil and gas inventory for CenSARA applies selected preliminary data derived from surveys in the Haynesville Shale 2011 draft inventory available as of October 2012 and under the consent of the sponsors of that project (NETAC). It must be noted that data from the 2011 Haynesville Shale Inventory Update used in this work is in its draft form and may be revised when the 2011 Haynesville Shale update is finalized.

The US EPA 2010 National Greenhouse Gas Inventory (EPA, 2012): This annual inventory is a comprehensive analysis of all greenhouse gas emissions sources and sinks in the United States, including those in the upstream oil and gas sector. The latest edition available covers years 1990 to 2010. The study has an independent analysis of emissions from natural gas systems that characterizes multiple source categories located at the well-site and in the downstream sector. Efforts were made to adjust emissions factors with available data by broad geographic producing regions of the United States (Midcontinent, Rocky Mountains, Gulf Coast, etc.) by accounting for regional average gas compositions and emissions deductions from state regulations or voluntary actions. A separate analysis is available for petroleum systems, which analyzes greenhouse gas emissions for the upstream oil sector as well as the transportation and refining of crude; these emissions are estimated at a national level, i.e. no regional specificity. Since the 2009 edition of the inventory (EPA, 2011), analysis of natural gas systems have incorporated adjustments to the inventory to account for hydraulic fracturing in source categories like well completions and well workovers. A limitation of this inventory is that it is focused on greenhouse gases and thus provides limited information on criteria pollutant emissions. However, activity data in these GHG national inventories have proven useful to gap-fill missing information for emissions estimates.

The Climate Registry Oil and Gas Production Protocol (TRC, 2010): This is an annex to The Climate Registry's (TRC) General Reporting Protocol (GRP) that provides guidance on estimating and reporting greenhouse gas emissions for members of TRC. The protocol focuses on emissions sources in the oil and gas exploration and production sector and provides high-level and low-level methodologies to estimate emissions, along with national default emissions factors and sample calculations. The protocol is limited to estimating emissions for greenhouse gases and thus does not provide emissions factors for criteria pollutants. However, methodologies often include a conversion method to extrapolate emissions from one hydrocarbon gas to another based on gas analyses, which can then be applied to estimate VOC and HAP emissions.

Texas Statewide Emissions Inventory from Oil and Gas Production (ERG, 2010): This is a comprehensive emissions inventory for base year 2008 characterizing area sources from upstream onshore oil and gas production sites in Texas. The emissions inventory analyzes criteria pollutant emissions of volatile organic compounds (VOC), nitrogen oxides (NOx), carbon monoxide (CO), particulate matter and hazardous air pollutants (HAPs). Among the sources included are dehydrators, oil and condensate tanks, oil and condensate loading, and combustion sources such as drilling rigs, artificial lift engines and compressors. The study compiled county-level activity data from the Texas Railroad Commission, and specific emissions and emission factor data for many source categories from multiple state and regional data sources such as vendor data and point source emissions inventory reports. As part of the study, an emissions calculator was developed to enable the Texas Commission on Environmental Quality to update the emissions inventory for future years by providing updated county-level activity data. Inventory development in the current CenSARA work for most Texas basins, except Permian, builds off the comprehensive database of activity and emissions factors compiled in this study.

WRAP Phase III Inventories (WRAP, 2012): These inventories were developed by the Western Regional Air Partnership, a regional planning organization for the Rocky Mountain states similar to CenSARA in the Central states. The Phase III inventories were the first-ever attempt to develop detailed, bottom-up, basin-level criteria pollutant inventories for all oil and gas area and point emissions sources. The inventories analyzed a wide range of activities including conventional, tight sands and CBM gas production, and oil production. The Phase III inventories cover many of the same source categories that are evaluated in the CenSARA inventories. Methodologies for estimating area source inventories, and emission factors and input activity factors were drawn from the WRAP Phase III inventories as a gap-filling method where other information was not available.

3.0 OBJECTIVES

States must prepare and submit an inventory of criteria and hazardous air pollutant emissions from all emissions sources within their jurisdiction every three years for inclusion in the National Emissions Inventory (NEI) compiled by the U.S. Environmental Protection Agency. This includes emissions from area sources in oil and gas systems. States' submissions for the 2011 NEI are due by the end of 2012. CenSARA is aware that there are data gaps and deficiencies in currently available data to characterize oil and gas area sources and has sponsored this study to make improvements in the resources available for the preparation of emissions inventories by developing reasonable and regionally-representative inputs for emissions calculations and by establishing a detailed and reproducible methodology for CenSARA members to apply in future NEI submissions. The following tasks were pursued in an effort to achieve this goal:

- Updated oil and gas production activity throughout the CenSARA region: estimating emissions at a basin-wide level requires key production surrogates to be compiled for the CenSARA domain on a county-level basis, and for these to be grouped by the geographical basin limits to obtain basin-level activity. These key activity factors include (but are not limited to) number of active wells by well type, gas production and oil production by well type, spud count, feet (depth) drilled by wellbore type, and water production by well type. ENVIRON/ERG compiled county-level activity data for calendar year 2011 for oil and gas producing CenSARA states; the goal was to use a single, consistent source of production statistics instead of collecting data from various state agency datasets which may present data in varying formats.
- Compiled basin-level data on equipment, activity and emissions factors for estimating emissions: ENVIRON researched and gathered data from a variety of resources, starting with 1) oil and gas operator surveys, 2) state minor source permit applications, and 3) literature review, to obtain detailed basin-specific data on operations, equipment and processes related to upstream oil and gas area sources. The data collected included equipment counts, emissions factors, activity factors for equipment (e.g. annual hours of operation, load factors, tier level, etc.), and gas compositions.
- Developed an Emissions Calculator Tool that estimates 2011 oil and gas area source emissions at the basin and county level: 2011 emissions estimates were compiled within a fully documented worksheet tool that enables CenSARA members to update activity and emissions data at the basin and/or county level for future use. The tool is based on the existing emissions calculator developed by ERG for Texas (ERG, 2010) but expanded to include inventory enhancements performed in the current study and added components that allow the states to update data by including specific control measures and adjusting emission factors. A tool for each CenSARA state was developed which includes a summary of annual emissions by county, by basin, by pollutant and by source classification codes (SCCs). Production statistics at the county and basin level are also summarized within the tool.
- Developed a database program to convert the emissions estimated by the Calculator Tool into an EIS-ready format for NEI submissions: A database program was developed to read the emissions summary in the Emissions Calculator Tool and convert emissions estimates

into an EIS-ready format by loading the inventory data into the EPA-supplied Consolidated Emissions Reporting Schema (CERS) EIS staging tables. The data stored in the EIS staging tables can be converted into valid XML files that are in compliance with the CERS using an EPA-supplied XML File Generator tool. This program and the emissions calculator provide the necessary set of tools for CenSARA members to both generate the oil and gas emissions and format them for NEI submission.

4.0 EMISSIONS INVENTORY DESCRIPTION

4.1 Temporal and Geographic Scope

The current inventory enhancement aims to characterize emissions from oil and gas activities for a base year 2011. The base year 2011 in this Project also aligns with the year inventoried in the upcoming EPA's National Emissions Inventory (NEI) for which the CenSARA states must submit 2011 emissions data for sources in their jurisdictions by December 31st, 2012. The NEI is prepared every three years by the US EPA based primarily upon emission estimates and emission model inputs provided by Regional, State, Local and Tribal air agencies.

Oil and gas facilities' operational and equipment information were collected through survey outreach for companies' activities in 2011. Drilling and production statistics (well counts, oil and gas production, spud count, etc.) for the CenSARA region were compiled for 2011. Final emissions were calculated on an annual basis as the majority of the oil and gas sources operate throughout the year. Preparation of inventories for future years will be facilitated by the ability of CenSARA States to update activity levels and emissions data contained in the 2011 version of the Emissions Calculator Tool developed in this Project.

The geographic scope of this inventory includes all CenSARA member states in which oil and gas activities took place during 2011 (Texas, Oklahoma, Louisiana, Arkansas, Kansas, Nebraska and Missouri). Oil and gas production in the remaining two CenSARA states (Iowa and Minnesota) is negligible. A map of oil and gas basins in the CenSARA region is provided in Figure 4-1. Basin geographical boundaries were largely based on USGS definitions but were modified slightly to align with county boundaries for ease of reporting county-level emissions in this inventory. Thus, counties that are geographically split between multiple basins were assigned to the single basin representing the largest geographic portion of the county to avoid the complexity of allocating activity factors and emissions at the sub-county level.

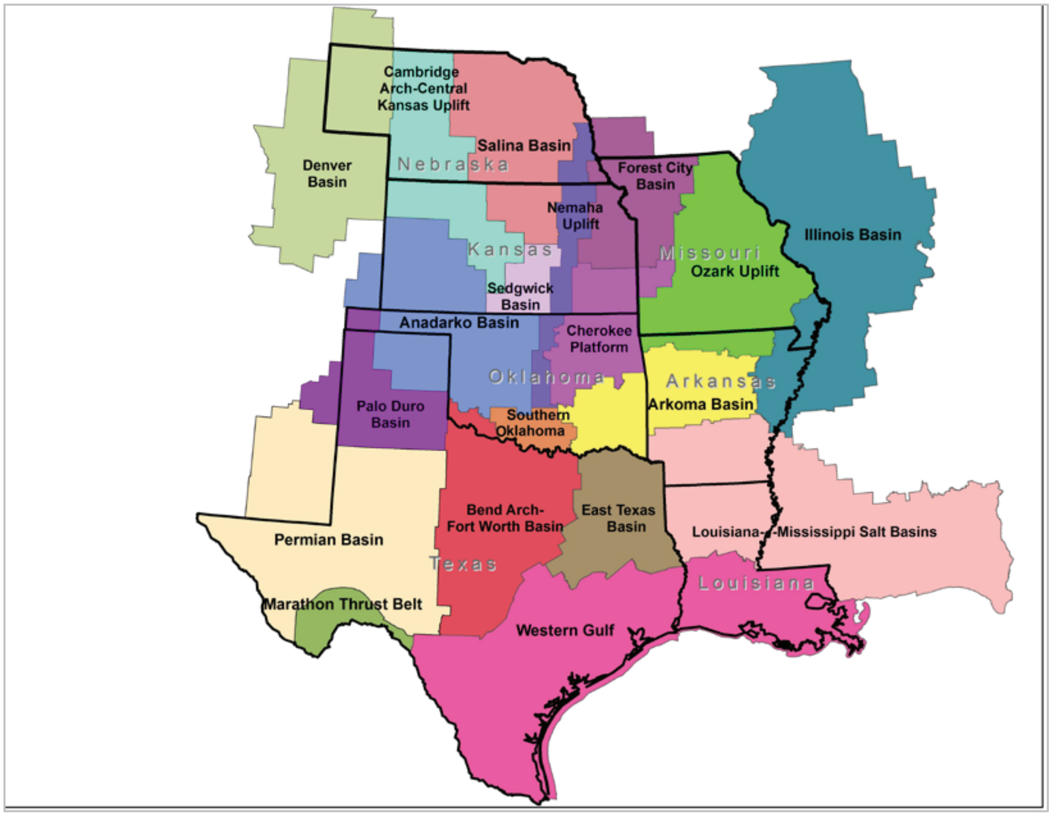

Figure 4-1. Oil and gas basins in the CenSARA region.

Although activities can vary within a basin (e.g. both oil and gas operations), the geologically influenced characteristics of a basin (e.g. depth, pressure, presence of water, oil quality, gas composition) directly affect activity parameters that describe oil and gas operations within the basin boundaries. A basin therefore represents a sufficiently detailed but tractable geographic unit for development of emissions factors and other input data for oil and gas area sources. Oil and gas area source emissions were therefore estimated for each basin based on equipment, activity and emissions factors compiled for the basin. Emissions were then allocated to each county within the basin based on the by-county spatial allocation surrogate (well counts, production and drilling) applicable to each source category. Counties falling within each basin are listed in Table A-1 of Appendix A.

4.2 Pollutants considered

Pollutants included in the oil and gas area source inventory are:

Criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter (specifically, PM10 and primary/direct PM2.5).

Greenhouse Gases (GHGs): methane, carbon dioxide and nitrous oxide.

Hazardous Air Pollutants (HAPs): Calculation of HAPs emissions was limited by the availability of emissions factors for indirect sources (such as combustion sources) and the availability of detailed gas speciation profiles for direct sources (such as leaking and venting area sources). The list of HAPs included in this inventory was based on those pollutants (benzene, ethylbenzene, toluene, xylene, formaldehyde and n-hexane) for which emissions data was available. It must be noted that gas analyses obtained through company surveys and literature data did not consistently include HAP concentrations, and in some cases HAPs speciation profiles were not available for a particular basin and/or source category. Thus, in these cases certain HAP emissions in a number of basins were not estimated, however the methodology is available to estimate these emissions within the calculator tool should speciation data become available.

Insufficient data was found to be available on ammonia (NH_3) emissions from all oil and gas area sources, thus this pollutant was not estimated within the inventory.

Hydrogen Sulfide (H_2S): Hydrogen sulfide emissions result from direct venting of sour gas. Generally, molar concentrations of H_2S in the gas are linked to the geographic location (basin) where the gas is produced. Data on produced gas H_2S content is limited and not all gas analyses include H_2S. H_2S emissions were estimated where data was available.

4.3 Scope of Emission Sources

Emissions were estimated for upstream oil and gas sector area sources including those during well drilling, completion (including fracing), production and recompletion phases, and associated sources located at or in close proximity to the well pad. These numerous small sources are generally not tracked as part of major point source permitting programs, and may or may not be tracked as part of minor source permitting programs (which vary from state to state). Source categories included in the inventory are:

- Artificial Lift Engines
- Wellhead Compressor Engines
- Lateral Compressor Engines
- Drilling Rigs
- Condensate Tanks
- Hydraulic Fracturing Pumps
- Well Completion Venting
- Blowdown Venting
- Casing Gas Venting
- Dehydrators
- Pneumatic Devices
- Heaters
- Crude Oil Tanks

- Produced Water Tanks
- Gas-Actuated Pneumatic Pumps
- Fugitive Emissions
- Mud Degassing
- Hydrocarbon Liquids Loading
- Flaring

This 2011 inventory builds off of the previous inventory for the Central states developed for CENRAP (Bar-Ilan, et al., 2008), and expands the scope of area source categories to gap-fill those emissions that have often not been included in past studies. These include emissions for mud degassing, produced water tanks, hydraulic fracturing pumps and casinghead gas venting. For source categories included in the original CENRAP study, new data or revisions to assumptions were incorporated as appropriate based on new data collected for this study. Examples of revisions to the CENRAP methodologies include updating the component list assumptions for fugitive emissions to include compressor seal fugitives. The current list of sources was cross-referenced with a list of source classification codes (SCCs) to facilitate the transfer by states of emissions data from this work to the 2011 NEI.

Source categories in this inventory were divided in two major groups: "high-tier" sources and "low-tier" sources. High-tier sources refer to the most significant area sources of NOx, VOC and HAPs based on ENVIRON's and ERG's experience from previous oil and gas area source inventory development studies and through discussions with CenSARA members. Major sources of VOC emissions in oil and gas operations are also significant sources of HAPs. Typically, oil and gas area sources are not large contributors to PM emission inventories. Low-tier sources refer to other source categories included in the inventory that are not considered high-tier. Table 4-1 lists the most significant sources of NOx, VOCs and HAPs emissions in the upstream oil and gas sector.

Table 4-1. Major area sources of NOx, VOCs and HAPs in the upstream oil and gas sector.

Significant emissions source of	
NOx	**VOCs and HAPs**
Artificial Lift Engines	Crude Oil and Condensate Tanks
Wellhead Compressor Engines	Well Completion Venting
Lateral Compressor Engines	Blowdown Venting
Drilling Rigs	Casing Gas Venting
Hydraulic Fracturing Pumps	Dehydrators
	Pneumatic Devices

Pollutant emissions for many source categories will vary according to the type of well (either gas or oil) since gas (or associated gas) compositions and process characteristics will differ according to the well type. For example, pollutants concentrations in fugitive leaks and any other venting emissions will vary between oil wells and gas wells, dehydrator equipment is mainly used in gas wells, casing gas venting is only applicable to oil wells, etc. Thus, an

enhanced methodology has been developed in this work to account for differences in emissions between well types by specifying basin-level and well-level calculation inputs, when feasible, and by applying more detailed production statistics to scale emissions such as oil versus gas well counts, horizontal versus vertical spuds, condensate production versus crude oil production, etc. as opposed to using more general surrogates such as active well counts, spud counts and oil production.

While the sources analyzed here may not represent a complete list of all oil and gas area source categories, this study includes the most significant area sources that contribute to the vast majority of emissions in a basin-level inventory based on the technical team's experience in development of oil and gas inventories. These sources are also the ones with the most complete set of input data that can be obtained through literature review and survey efforts, thus decreasing the level of uncertainty in the emissions estimates. Sources that could not be included due to limited data availability were: salt water injection engines, well pad construction equipment, workover equipment and some associated mobile sources. Associated on-road mobile sources operating in the well field such as service vehicles used during construction, drilling and production phases, are captured under some states' mobile source emissions inventories and are not included in this inventory.

4.4 Oil and Gas Activity Updates for the CenSARA Region

4.4.1 Obtaining Oil and Gas Activity Data

A subtask in this project was to develop 2011 county-level activity data of oil and natural gas upstream production and drilling activities for the CenSARA states. Typically, these data are available on oil and gas commission websites for each state; however it is typically very cumbersome to obtain the data in this way as they are presented in various formats and require significant processing to make them useable for inventory development. It is therefore advantageous to obtain as much information as possible from a single data source or clearinghouse in a standard format. ERG was able to make arrangements to obtain activity data for the 2011 base year from DrillingInfo's HPDI database for production wells (Drillinginfo, Inc. 2012). These data were supplemented by data obtained from state oil and gas commission websites and state-level drilling information from RigData.

Table 4-2 presents the activity data parameters used to calculate oil and gas emissions. The derived level of aggregation is at the county-level. In total, there are 783 counties in the CenSARA oil and gas region (which does not include Iowa and Minnesota).

Table 4-2. County-level activity data parameters needed for emissions estimation.

Data Parameter
Oil Produced (barrels or BBL)
Natural Gas Produced (thousand standard cubic feet or MCF)
Condensate Produced (BBL)
Casinghead Gas Produced (MCF)
Oil Well Counts
Natural Gas Well Counts
Oil Well Completions
Natural Gas Well Completions
Produced Water at Oil Wells (BBL)
Produced Water at Gas Wells (BBL)
Spud Counts (Vertical, Horizontal, Directional)
Feet Drilled (Vertical, Horizontal, Directional)

With the exception of Feet Drilled, all of the above parameters are reported fields in HPDI. "Feet Drilled" was estimated by calculating a "feet per drilling day" rate per well, which is roughly the well depth divided by the number of days between the Completion Date and the Spud Date. This rate was then multiplied by the number of drilling days to obtain the "Feet Drilled" value. For wells that were spudded and completed within 2011, the calculation was straightforward. For wells that began drilling prior to 2011 and were completed in 2011 or began drilling in 2011 and were completed in 2012, only the portion of drilling occurring in 2011 was considered.

Table 4-3 presents the activity data sources for each of the activity data parameters identified in Table 4-2.

Table 4-3. Production and drilling data sources by state.

State Abbreviation	Oil/ Casinghead Gas Production	Natural Gas/ Condensate Production	Produced Water	Well Completions	Spud Counts/ Feet Drilled
AR	2011 HPDI	2011 HPDI	2011 HPDI	Oil Gas Commission Website	2010 HPDI; RigData
KS	2011 HPDI	2011 HPDI	Not Available	2011 HPDI	Kansas Corporation Commission Website
LA	2011 HPDI	2011 HPDI	2011 HPDI	2011 HPDI	2010 HPDI; RigData
MO	2011 HPDI	2011 HPDI	Not Available	2011 HPDI	2010 HPDI; RigData
NE	2011 HPDI	2011 HPDI	2011 HPDI	2011 HPDI	2011 HPDI
OK	2011 HPDI	2011 HPDI	Not Available	Oil Gas Commission Website	2010 HPDI; RigData
TX	2011 HPDI	2011 HPDI	2011 HPDI	2011 HPDI	2010 HPDI; RigData

HPDI was the source for all the oil, casinghead gas, natural gas, and condensate data for 2011. Additionally:

- Produced water data were available in HPDI for Arkansas, Louisiana, Nebraska, and Texas. Produced water data were not available in HPDI or from the states for Kansas, Missouri and Oklahoma.
- Well completions were available for 2011 in HPDI for Kansas, Louisiana, Missouri, Nebraska, and Texas. For Arkansas and Oklahoma, well completion counts were obtained from their respective Oil and Gas Commission websites.
- Spud Counts and Feet Drilled were only available for 2011 in HPDI for Nebraska. For Kansas, spud counts and feet drilled were obtained from the Kansas Corporation Commission, Oil and Gas Conservation Division website. For Arkansas, Louisiana, Missouri, Oklahoma, and Texas, the 2010 feet drilled from HPDI were scaled to 2011 using state-level well starts for each state obtained from RigData.

4.4.1.1 DrillingInfo Database in HPDI

The first data source for obtaining activity data was information from HPDI's DrillingInfo. This subscription-based information source extracts well-level data from state oil and gas commission websites. The data, while publically available, are periodically extracted from each commission website, and prepared in a standardized format. As part of EPA's Enforcement Activities, an HPDI annual subscription is purchased allowing data downloads, or "refreshes", to be obtained throughout the year. In accordance with the licensing agreement, well-level data is proprietary, but derived products, such as aggregation at the county-level, are acceptable for public dissemination. EPA granted authorization of this derived data processing file for CenSARA's use to support this project. For the CenSARA states, there are over 2 million well-level data records.

ERG extracted well identification (HPDIHeader), production (HPDIProduction), and test (HPDIWellTest) information for onshore wells and leases. Table 4-4 provides details on the available data by state, as of the refresh date. Table 4-4 also includes the update frequency of the data by state and those states with available test data.

Table 4-4. HPDI data coverage by state.

State Abbreviation	Production Group	Update Frequency	Latest Production Data	Test Data Available
AR	Well	Monthly	4/1/2012	No
KS	Lease	Monthly	3/1/2012	No
LA	Well/Unit[a]	Monthly	5/2/2012	Yes
MO	Lease	Yearly	1/1/2012	No
NE	Well	Monthly	3/1/2012	No
OK	Well	Monthly	3/1/2012	No
TX	Oil – Lease; Gas – Well	Twice Monthly	5/1/2012	Yes

[a] Louisiana Department of Natural Resources defines a unit as the “surface area that encompasses part of or the entirety of a reservoir.”

ERG imported all of the data from HPDI into an Oracle database for processing. The Oracle database combines and processes all of the download files into one table of all production wells for the EPA Enforcement Universe Database. The processing steps are discussed below.

1) *Combine Annual Production and Descriptive Information*: For each entity[3], ERG combined the annual production with the descriptive information (e.g., API number, lease name, location, operator, completion date, spud date, latest production date) from the HPDIHeader table to create the Wells table for the EPA Enforcement Universe Database. Appendix B presents the names and descriptions of the fields included in the Wells table.
2) *Remove Duplicate Wells*: HPDI includes duplicate information for wells in some states because the data are stored by completion zone rather than at the well or lease level. Because all of the other descriptive data in HPDI are at the well or lease level, ERG combined duplicate API numbers (i.e., well bore identifiers[4]) into a single record to avoid over counting wells. ERG excluded the records with missing API numbers (i.e., API_NO is null) from this “remove duplicate well” step. This could result in some over counting of wells, but this should be minimal

[3] HPDI assigns a unique number to each property (i.e., lease, well, unit) in the ENTITY_ID field.

[4] API numbers are up to 14 digits long and are broken into four segments. The first two digits correspond to the state; the next three digits correspond to the county in the state. The next five digits are the unique well identifier for the county. The next two digits are for the directional side tracks (i.e., horizontal or directional drills that each have different bottom hole locations), with 00 representing the original well bore. The last two digits are the event sequence code that distinguish between original completion, reentries, recompletion, and hole deepenings. Some states do not assign directional side tracks or event sequence codes.

because a limited number of wells/leases did not have API numbers and there were a small percentage of duplicate wells identified. [5]

1) *Create Updated Active Status Flag (ACTIVE_FLAG)*: ERG created an updated active status flag (ACTIVE_FLAG) using the latest production date (LAST_PROD_DATE) after determining that HPDI's status flag (STATUS) was not always accurate as part of the 2011 version of the Universe Database.[6]

2) *Create Production Flags (PROD09_FLAG, PROD10_FLAG, PROD11_FLAG)*: ERG created production flags to identify miscellaneous well types (e.g., injection, observation, abandoned, pressure maintenance, N/A) that have oil and gas production in 2009 (PROD09_FLAG), 2010 (PROD10_FLAG), and 2011 (PROD11_FLAG). The production flag is "Yes" if the annual oil or gas production is greater than zero.

3) *Assign Each Well as Oil or Gas*: Each well was reviewed to determine whether it should be labeled as an oil or a gas well. As such, the following hierarchy was used:

   a. HPDI designations of oil or gas
   b. Wells that had 2011 oil production, but no 2011 natural gas production were assigned as "oil" wells;
   c. Wells that has 2011 gas production, but no 2011 oil production were assigned as "gas" wells; and
   d. Wells that had both 2011 oil and gas production were assigned "oil" or "gas" based on converting the oil and gas production data into BTU and selecting the larger of the two.

4.4.1.2 State Oil and Gas Commission Websites

To fill in missing data not available in HPDI, the state oil and gas commission websites were searched and the following data were used:

- 2011 well completions for Arkansas wells were obtained from the Weekly Reports found in the Arkansas Oil and Gas Commission website (http://www.aogc.state.ar.us/permitreportarch.htm) and were summed to each county
- 2011 spud counts and feet drilled for Kansas wells were obtained from the Kansas Oil and Gas Commission website (http://www.kgs.ku.edu/PRS/Ora_Archive/ks_wells.zip) and summed to each county
- 2011 well completions for Oklahoma counties were obtained from the Oklahoma Oil and Gas Commission website (http://www.occeweb.com/og/2011%20Annual%20Report.pdf).

[5] Duplicate wells in states with missing API numbers could be identified using the permit number, which should be unique for each well.
[6] ERG found some wells with an "Active" STATUS had not produced in a number of years, while some wells with an "Inactive" STATUS had production data for 2010.

4.4.1.3 RigData

Drilling data in HPDI for 2011 was sparse, with only 2011 information from Nebraska available. As such, 2011 estimates needed to be generated for the remaining states. We used RigData (http://www.rigdata.com) as a source of Well Starts by year. The 2010 spud counts and feet drilled in HPDI for Arkansas, Kansas, Louisiana, Missouri, Oklahoma, and Texas were adjusted by the ratio of wells starts from 2010 to 2011 for each of these states.

4.4.2 CenSARA Oil and Gas Production Statistics for 2011

A summary of the resulting oil and gas production statistics by basin obtained through the HPDI database is presented in Table 4-5. This includes some key activity indicators such as natural gas production, casing head gas production, crude oil production, condensate production, gas well and oil well counts, and water production. Statistics at the county-level and by well type for each surrogate are included in the Emissions Calculator Tool developed in this work. Production statistics were used as scaling surrogates for estimating emissions at a county level. Surrogate values extracted from HPDI have detail at the well-level; for example, the classification of well counts, water production, spud count, well completions and production is separated by well type (gas or oil). This allows regional scaling of emissions for a particular source category by capturing the difference in speciation of emissions which is affected by pollutant concentrations in the gas and by operational parameters characteristic of each well type. It is important to note that produced water information in the HPDI database were available only for four of the seven oil and gas producing states in CenSARA (Nebraska, Arkansas, Texas and Louisiana). Therefore, basin-wide water production numbers are not always representative of the basin total as several basins are located in more than one state, including those for which water production was not available.

Table 4-5. Basin-wide production statistics for the CenSARA region.

Basin	Crude Oil Production (bbl/yr)	Condensate Production (bbl/yr)	Casinghead Gas Production (MCF/yr)	Natural Gas Production (MCF/yr)	Oil Well Count	Gas Well Count	Produced water (bbl/yr)*
Anadarko Basin	38,849,509	23,404,233	128,500,510	1,667,680,731	27,048	67,323	63,229,429
Arkoma Basin	1,209,675	105,776	1,192,053	1,566,638,491	1,871	18,341	-
Bend Arch-Fort Worth Basin	27,124,167	3,711,767	90,863,234	2,087,999,221	53,312	25,082	756,141,538
Cambridge Arch-Central Kansas Uplift	17,441,133	938,882	-	10,535,459	26,195	2,601	35,704,420
Cherokee Platform	9,221,921	782,270	10,409,412	103,922,916	28,782	15,622	-
Denver Basin	393,004	751,191	35,498	1,165,036	106	775	12,254,436
East Texas Basin	15,402,824	6,062,203	18,305,801	1,839,495,352	21,342	23,326	398,204,370
Forest City Basin	1,328,525	17,874	-	277,443	7,644	288	3,726,059
Illinois Basin	-	-	-	2,573,300	-	24	-
Louisiana-Mississippi Salt Basins	14,780,502	2,150,516	16,345,448	2,505,781,194	18,101	17,316	522,274,052
Marathon Thrust Belt	4,064	82,300	161,216	41,565,726	13	675	577,272
Nemaha Uplift	4,619,574	1,077,952	10,359,925	23,190,001	9,916	2,192	-
Ozark Uplift	-	-	-	-	-	-	-
Palo Duro Basin	3,561,696	81,566	2,693,538	18,964,419	1,818	1,082	32,039,947
Permian Basin	299,041,345	5,683,488	669,798,454	529,029,342	145,544	20,295	3,226,217,276

Basin	Crude Oil Production (bbl/yr)	Condensate Production (bbl/yr)	Casinghead Gas Production (MCF/yr)	Natural Gas Production (MCF/yr)	Oil Well Count	Gas Well Count	Produced water (bbl/yr)*
Salina Basin	272,924	8,187	-	691	493	1	181,834
Sedgwick Basin	3,063,174	1,523,188	-	36,776,210	5,417	3,401	-
Southern Oklahoma	9,376,880	1,930,874	20,170,919	77,555,318	9,256	3,037	-
Western Gulf	144,929,906	61,146,973	311,480,930	2,101,896,695	45,439	25,923	1,489,520,630
CenSARA Region Total	**590,620,823**	**109,459,240**	**1,280,316,938**	**12,615,047,545**	**402,297**	**227,304**	**6,540,071,263**

*Produced water is not representative of each basin's total since water production statistics were not available for every state. Water production was available for AR, LA, NE and TX only.

Table 4-6 shows the distribution of the production levels by state and within the basin portion of each state.

Table 4-6. Summary of production, well counts and spud count by state and basin for CenSARA.

State	Basin	Crude Oil Production (bbl/yr)	Natural Gas Production (MCF/yr)	Active Well Counts	Total Spuds
Arkansas	Arkoma Basin	-	1,070,434,560	7,976	859
	Illinois Basin	-	2,573,300	24	-
	Louisiana-Mississippi Salt Basins	5,154,192	4,577,320	2,485	187
	Ozark Uplift	-	-	-	-
	State Total	**5,154,192**	**1,077,585,180**	**10,485**	**1,046**
Kansas	Anadarko Basin	11,917,770	223,851,902	33,672	676
	Cambridge Arch-Central Kansas Uplift	16,996,535	9,756,144	28,375	808
	Cherokee Platform	1,885,177	40,742,354	22,524	780
	Forest City Basin	1,199,139	277,443	7,873	761
	Nemaha Uplift	1,758,271	250,264	6,890	102
	Salina Basin	272,924	691	494	22
	Sedgwick Basin	3,063,174	36,776,210	8,818	257
	State Total	**37,092,990**	**311,655,008**	**108,646**	**3,406**
Louisiana	Louisiana-Mississippi Salt Basins	9,626,310	2,501,203,874	32,932	520
	Western Gulf	49,454,095	351,991,634	5,510	101
	State Total	**59,080,405**	**2,853,195,508**	**38,442**	**621**
Missouri	Cherokee Platform	27,401	-	5	-
	Forest City Basin	85,409	-	29	-

State	Basin	Crude Oil Production (bbl/yr)	Natural Gas Production (MCF/yr)	Active Well Counts	Total Spuds
	Illinois Basin	-	-	-	-
	Ozark Uplift	-	-	-	-
	State Total	**112,810**	**-**	**34**	**-**
Nebraska	Cambridge Arch-Central Kansas Uplift	444,598	779,315	421	35
	Denver Basin	393,004	1,165,036	881	6
	Forest City Basin	43,977	-	30	12
	Nemaha Uplift	-	-	-	-
	Salina Basin	-	-	-	-
	State Total	**881,579**	**1,944,351**	**1,332**	**53**
Oklahoma	Anadarko Basin	12,337,317	816,787,833	32,765	243
	Arkoma Basin	1,209,675	496,203,931	12,236	93
	Bend Arch-Fort Worth Basin	151,100	-	143	4
	Cherokee Platform	7,309,343	63,180,562	21,875	96
	Nemaha Uplift	2,861,303	22,939,737	5,218	31
	Palo Duro Basin	58,349	782,668	141	-
	Southern Oklahoma	9,376,880	77,555,318	12,293	19
	State Total	**33,303,967**	**1,477,450,049**	**84,671**	**486**
Texas	Anadarko Basin	14,594,422	627,040,996	27,934	565
	Bend Arch-Fort Worth Basin	26,973,067	2,087,999,221	78,251	1,530
	East Texas Basin	15,402,824	1,839,495,352	44,668	629

State	Basin	Crude Oil Production (bbl/yr)	Natural Gas Production (MCF/yr)	Active Well Counts	Total Spuds
	Marathon Thrust Belt	4,064	41,565,726	688	8
	Palo Duro Basin	3,503,347	18,181,751	2,759	19
	Permian Basin	299,041,345	529,029,342	165,839	2,201
	Western Gulf	95,475,811	1,749,905,061	65,852	1,570
	State Total	**454,994,880**	**6,893,217,449**	**385,991**	**6,522**
CenSARA Region	**Total**	**590,620,823**	**12,615,047,545**	**402,297**	**227,304**

A significant amount of upstream oil and gas emissions occur during drilling; these emissions will be affected by the operational characteristics of the type of well drilled. The HPDI database provides a highly detailed breakdown of the drilling activity, which separates the main activity drivers (spud count and feet drilled) by well type (gas or oil) and by wellbore type (horizontal or vertical wells). This allows for application of different emissions rates depending on the type of well and wellbore and it also enables a better allocation of the drilling activity that likely involves hydraulic fracturing techniques.

Table 4-7. Summary of drilling activity by basin.

Basin	Spud Count	Total Vertical Feet Drilled	Total Horizontal Feet Drilled	Well Completions
Anadarko Basin	1,484	5,350,439	6,014,414	1,544
Arkoma Basin	952	99,081	4,311,829	1,327
Bend Arch-Fort Worth Basin	1,534	1,129,252	9,850,854	1,802
Cambridge Arch-Central Kansas Uplift	843	3,086,133	-	232
Cherokee Platform	876	1,004,617	60,137	438
Denver Basin	6	43,645	-	7
East Texas Basin	629	2,696,345	4,731,632	530
Forest City Basin	773	598,428	-	43
Illinois Basin	-	-	-	-
Louisiana-Mississippi Salt Basins	707	1,340,228	4,675,104	1,477
Marathon Thrust Belt	8	89,113	-	-
Nemaha Uplift	133	490,563	54,484	192
Ozark Uplift	-	-	-	-
Palo Duro Basin	19	78,880	11,034	13
Permian Basin	2,201	18,911,110	2,184,534	1,706
Salina Basin	22	72,212	-	5
Sedgwick Basin	257	1,209,269	-	44
Southern Oklahoma	19	63,827	118,125	350
Western Gulf	1,671	4,845,453	11,352,479	2,006
CenSARA Region Total	**12,134**	**41,108,593**	**43,364,626**	**11,716**

5.0 INPUT DATA GATHERING

This section describes the different sources of information used to gather activity inputs used to estimate oil and gas area source emissions. Input data include the fractional usage of equipment at well-sites, properties of the equipment such as size, annual usage hours, emissions controls and emissions factors, process characteristics such as venting rates and well component counts, and chemical composition analyses used to determine pollutant emission rates. An attempt was made to obtain basin-specific input data applicable to each source category listed in Section 4.3. Where basin-specific data were unavailable, national averages or other available regional data were used, particularly for estimating emissions from lower-tier source categories. CenSARA member states will be able to update this information in future inventories using the emissions calculator tool developed in this study if more detailed data is available in the future.

Three different approaches were used to obtain data on equipment and process activities:

1) Conduct new industry surveys of oil and gas operators within the CenSARA region,
2) Review oil and gas equipment and activity datasets developed by state agencies and state facility permits and
3) Obtain information from existing studies or use averages from survey data from various basins in CenSARA.

These three approaches are described in more detail below.

5.1 Industrial Surveys

In the anticipation that not all information necessary to estimate 2011 emissions for the selected area source categories would be available through state agency datasets and existing literature, a limited industrial survey was conducted to gather representative data at the basin level on field equipment and operations for the higher tier oil and gas source categories. The survey effort was targeted at the major oil and gas producers operating in each basin within the CenSARA region. It has been ENVIRON's experience with previous regional emissions inventories, such as the Rocky Mountain States oil and gas inventories prepared for the Western Regional Air Partnership (Bar-Ilan et al., 2008), that direct surveys of oil and gas operators are needed to properly characterize equipment, well configuration, usage, processes, and emissions factors.

5.1.1 Geographical Scope

ENVIRON narrowed the geographical scope of the survey outreach to the major oil and gas producing basins of particular interest to CenSARA states. For example, the Texas Commission on Environmental Quality (TCEQ) indicated that they were mainly interested in developing new data for the Permian Basin as they already have an established methodology and inputs for estimating oil and gas emissions in other basins within the State. Louisiana Department of Environmental Quality (LADEQ) requested that the survey focus on activities in the northern portion of the state where potential air quality issues in the area of Baton-Rouge could be

focused on, thus the Louisiana-Mississippi Salts Flats basin was of particular interest to them. Discussions with Oklahoma, Arkansas and Kansas determined that survey efforts would focus on areas where the bulk of the production occurs within each of these states, including the Anadarko, Arkoma and Cambridge Arch-Central Kansas Uplift basins. Cambridge Arch is also a major oil and gas producing region in Nebraska. Thus, surveys were developed to gather data for the following basins:

- Anadarko Basin
- Arkoma Basin
- Louisiana-Mississippi Salt Basins
- Cambridge Arch-Central Kansas Uplift
- Sedgwick Basin
- Permian Basin

Information in the survey was specifically requested at the basin level and for calendar year 2011. As part of the survey, operators were asked to list the counties within each basin where they have operations in order to verify the proper region to apply the data being collected.

5.1.2 Survey Description and Development

The survey effort was focused on collecting field data on the most significant area sources of NOx, VOC and HAPs referred to here as “high-tier” source categories and listed in Table 4-1. These sources can have a high variability in emissions and operation parameters across different basins, hence estimates for these sources benefit from industry data at the basin level. A worksheet format survey form was prepared for each targeted operating company to fill out and return in electronic format. The survey design was based on previous oil and gas inventory surveys used in the IPAMS/WRAP Phase III oil and gas emission inventory development project (Bar-Ilan et al., 2008). The survey consisted of various tabs requesting information for each of the high-tier source categories, as well as an introductory tab describing the purpose of the survey, the regional scope, and instructions for filling in the requested information. Another tab gathered/confirmed contact information of the surveyed company and allowed them to enter the counties of operation and any notes or comments on the data provided. The set of survey forms used in this study are included as electronic Appendix D.

Each source category tab requested basic information needed to determine input values for basin-level emissions calculations. Among the data fields included were equipment counts, hours of operation, horsepower, load factors, firing rates, emissions factors, engines configuration for drilling rigs, venting rates and event counts for venting categories, well configuration for pneumatics and fugitives, and information on emissions controls such as control method, fraction controlled and control efficiency. Where appropriate, data was requested by well type to account for differences between oil and gas wells in equipment configurations, venting rates and emissions factors. Each survey also requested information on gas composition analyses of produced gas by well type (gas or oil), necessary to estimate VOC, HAPs, methane (CH_4), and hydrogen sulfide (H_2S) emissions for venting/leaking source

categories based on the pollutants concentrations in the gas. Operators were asked to provide any supplemental documents to aid in emissions calculations including: input and output files from emissions models such as EPA TANKS, E&P Tank and GRI-GlyCalc; equipment inventories for compressor engines, drill rigs, and artificial lifts; and copies of produced gas composition analyses.

5.1.3 Survey Outreach Process and Results

ENVIRON analyzed oil and gas production by operator for 2011 from the HPDI database and state oil and gas commission records and developed a list of the top oil producing and top gas producing companies in each basin. Production ownership varied considerably by basin for oil and gas, thus a recommended list of selected companies for the survey outreach was developed based on the representation of at least 50% ownership of production (both oil & gas) within each basin or the selection of the top 10 companies (in the case they had at least 50% ownership). This resulted in a comprehensive list of 127 oil and gas companies recommended for survey. ENVIRON has developed working relationships with many major oil and gas companies, particularly through ongoing oil and gas emissions projects such as the IPAMS/WRAP Phase III (Bar-Ilan et al., 2008). ENVIRON and CenSARA state agencies worked together to establish contacts at selected companies for which ENVIRON did not already have a suitable contact. Between the collaboration of ENVIRON and CenSARA members, a list of contacts for 82 companies was compiled; individual (non-generic) contacts for 45 operators out of the 127 selected could not be identified during the survey outreach effort. Subsequently, CenSARA or state agencies sent each company contact within their jurisdiction an introductory letter explaining the purpose of the survey, its importance to the operator and to the state agencies, and requesting their cooperation in responding to the survey request in a timely manner.

ENVIRON sent electronic surveys to each of the 82 companies for which an electronic contact was available. The email communication included a survey form for each of the basins in which the company was a significant oil and gas operator. Thus, several companies such as Chesapeake Operating, Inc. and XTO Energy, Inc. received requests to fill two to three surveys, one for each basin where they have operations, yielding a total of 99 surveys that were sent out among the top oil and top gas producing companies of the CenSARA region. A window of 30 calendar days was given to the companies to fill-in the surveys, with a subsequent extension of 1-2 weeks for some companies that requested it. Eleven (11) companies sent responses stating that they declined to participate; the most frequent explanation for declining was lack of resources to fill-in the survey at the time of request due to concurrent requirements to complete national Subpart W GHG inventory reporting to the EPA. Twenty-one (21) companies agreed to participate, resulting in 29 surveys (out of 99) filled by operators/contractors and returned to ENVIRON; these are shown in Table 5-1. The remaining 50 companies contacted did not respond to any communications. Survey response rates by basin are summarized in Tables 5-2.

Table 5-1. Participating companies in the survey outreach effort.

Company Name	Basin of Major Operation
Baird Oil Company LLC	Cambridge Arch-Central Kansas Uplift
BHP Billiton	Arkoma
Bonanza Creek	Louisiana-Mississippi Salt Flats
Chaparral Energy	Anadarko
Chesapeake Energy	Anadarko, Arkoma
ConocoPhillips	Anadarko
Edmiston Oil Company, Inc	Sedgwick, Cambridge Arch-Central Kansas Uplift
John O. Farmer Inc	Cambridge Arch-Central Kansas Uplift
Merit Energy	Anadarko
Murfin Drilling Company Inc	Cambridge Arch-Central Kansas Uplift
Noble Energy, Inc	Cambridge Arch-Central Kansas Uplift
Priority Oil and Gas, LLC	Cambridge Arch-Central Kansas Uplift
Ritchie Exploration	Cambridge Arch-Central Kansas Uplift, Anadarko
Sheridan Production Company	Arkoma
Southwestern Energy Company	Arkoma
Stephens Production Company	Arkoma
Trans Pacific Oil	Anadarko, Cambridge Arch-Central Kansas Uplift, Sedgwick
Vess Oil Corporation	Cambridge Arch-Central Kansas Uplift
Whiting Oil and Gas Corporation	Anadarko, Louisiana-Mississippi Salt Flats
Woolsey Operating Co, LLC	Sedgwick
XTO Energy	Anadarko, Louisiana-Mississippi Salt Flats, Permian

Table 5-2. Summary of survey responses and ownership of responses by basin.

Basin	Surveys Sent	Surveys Returned	Percent Response	Basin-wide Gas Production Ownership of Respondents (%)	Basin-wide Oil Production Ownership of Respondents (%)
Anadarko Basin	26	7	26.9%	21.1%	18.4%
Arkoma Basin	17	6	35.3%	68.5%	32.5%
Louisiana-Mississippi Salt Basins	13	3	23.1%	2.4%	15.7%
Cambridge Arch-Central Kansas Uplift	18	9	50.0%	38.0%	16.7%
Sedgwick Basin	15	3	20.0%	13.1%	11.8%
Permian Basin	10	1	10.0%	4.1%	2.6%
Total	**99**	**29**	**29.3%**		

Table 5-2 shows the production ownership of the survey respondents in each basin. This percent ownership provides a qualitative assessment of the level of basin-wide representation that was achieved from the survey effort. Ideally, if most surveyed companies had participated, 50-90 percent of basin production would have been reflected in the returned surveys. The

largest number of responses was obtained from small-to-large operators in the Cambridge Arch Basin, and two major gas producers (Priority and Noble Energy) responded to the survey, representing 38% of basin-wide gas production in the Cambridge Arch. Although responses were limited, the Arkoma basin was well represented for gas production and to a lesser extent for oil production as a result of the participation of key players such as Sheridan and Southwestern Energy. Although several responses for the Louisiana-Mississippi Salt Basins were received for oil producers, it should be noted that the surveys were intentionally not sent to the major gas producers in the basin as they were part of the recent Haynesville Shale emissions study described below in the literature review. Overall, the percent response from operators within all the basins was lower than desired, particularly for oil companies in the Permian Basin, the largest oil producing region in Texas, for which only one response was returned.

Survey data from responding companies were evaluated for quality, applicability and usefulness. Returned surveys were not consistently filled for all source categories. For some basins, sufficient and useful data was collected from survey responses for many of the source categories, and for other basins/source combinations, very little useful data was provided in the surveys. Criteria for evaluating surveys were:

- Quality of data: survey responses were assessed for quality to determine if specific data were beyond the typical range of values for a parameter based on ENVIRON's experience from previous oil and gas survey efforts or in comparison to other data sources. In cases of specific responses of questionable quality, ENVIRON made efforts to further examine the data by contacting the surveyed company and asking for further clarification on the data provided. ENVIRON also examined the company's levels of operation to evaluate if it would warrant any unusually high or low level of activity for particular data fields. Data that were determined to lie well outside a typical range without a reasonable explanation were rejected from inclusion in the final compilation. Incidences of this were isolated to a few responders.
- Applicability and usefulness: This relates to data that were provided in a different format or were simply incomplete and could not easily be converted or assigned to representative equipment and process input data required by the methodology. For example, for a particular basin there was a single response for lateral compressor engines which applied to an electric compressor from one small operator. This data could not be assumed to be representative of the entire basin's usage of lateral compressors and thus was not used. On occasion, useful and representative data were provided in different formats that allowed the estimations of emissions for a particular source by converting the data to the desired format or making changes to the methodology.

Each data field gathered from survey responses was averaged primarily by basin, by well type when applicable, and by any other breakdown relevant to the source category; for example drilling rig data were averaged by horizontal and vertical configurations of drill rigs. When applicable and when sufficient data were available, the weighted average of some data fields was estimated using operator-production surrogates (gas production, oil production, well counts) that were available from the HPDI data. For example, the data field "fraction of wells

with wellhead compressors" was provided by groups of companies within a few basins, and the final input was derived from the weighted average based on operator well counts to arrive at a more representative value for the basin.

5.2 State Permit Data Review

5.2.1 Minor Source Permits

Each state's Air Quality Division (or equivalent agency) has a set of air permitting programs that may or may not cover a number of oil and gas area sources. Minor source permits are typically a sub-classification of construction or operating permits required for new and modified minor sources. A minor source is any source that emits less than a major source threshold. Some states have a broad scope of sources and/or facilities that are subject to this type of permit, covering facilities such as oil and gas well-sites (often termed production facilities), where many of the oil and gas area sources are located. Other states' permitting programs focus on major sources and only cover minor sources located at oil and gas downstream facilities (e.g. gas plants, compressors on transmission lines) that would generally not qualify as an area source category.

Some data fields that could not be collected through survey responses were derived from permit applications from states' minor (or synthetic minor) source permitting programs such as those of Oklahoma, Kansas and Louisiana. In these states, oil and gas facilities, including new and modified well sites, require a construction and/or operating permit application that includes the calculation of emissions from minor sources at the facility; these may include: well heaters, condensate/crude oil tanks, wellhead compressor engines, artificial lift engines, dehydrator units, fugitives, flaring, liquids loading, and other engines located on site. Many of these "minor" sources are typically classified as an oil and gas area source category. Thus, data from minor source permits can be useful for the estimation of area source emissions. A caveat in utilizing permit data is that emissions estimates for permit applications are often based on conservative assumptions to reflect the highest level of emissions achievable by a facility or the potential to emit (PTE). It should also be noted that minor sources located further downstream in the oil and gas process than a well site (such as a tank battery or compressor station) may not represent activity at the well site. Nevertheless, minor source permit data were useful for gap-filling many data fields for source category/basin combinations with regionally-specific information that was not otherwise available from the survey responses or other data sources. Permit applications for 'production facilities' (well sites) denote the county where the facility is located, thus providing a way for allocating the activity data to the basins of interest, i.e., Louisiana Mississippi Salt Flats, Anadarko and Arkoma, Cambridge and Sedgwick.

5.2.2 Permit Data Mining Procedure and Examples

CenSARA member states worked with ENVIRON to provide access to hard copies of minor source permit applications for production facilities that required a 2011 permit. Oklahoma members provided access to a library of CY2011 synthetic minor source permit applications for production facilities at Anadarko and Arkoma. Data was pulled from 25 permits for source

categories of interest including compressor engines, artificial lift engines, condensate tanks and heaters.

Louisiana provided a comprehensive list of oil and gas related Agency Interest (AI) numbers, an identification number assigned to every facility regulated by the Louisiana Department of Environmental (LADEQ,) and categorized under a source industrial classification (SIC) code. Production facilities were filtered from the AI database based on the SIC codes for well sites, and sample applications were queried in LADEQ's Electronic Document Management System (EDMS) by the AI numbers. A bank of 30 permit applications were reviewed to extract emissions data for compressor engines, artificial lift engines, condensate/oil tanks, and dehydrators in production facilities located in the Louisiana Mississippi Salt Flats basin. Examples of specific data fields that were extracted from air permits and used as calculation inputs for source categories' emissions are shown in Table 5-3.

Table 5-3. Examples of specific data fields gap-filled by state permit data.

Source Category	Data field(s)	Comments on derivation of data
Condensate/oil tanks	Heating value of flash gas; tank losses per unit throughput (lbs-VOC/bbl)	Tanks losses per unit throughput values were derived by dividing annual uncontrolled tank emissions (flashing +w/b) by the liquid throughput of the tank in barrels, and taking a throughput-based weighted average from all permits.
	Controls: fraction of tank throughput flared	
Dehydrators	Still vent VOC emissions per unit of gas throughput (lbs-VOC/MMSCF); dehydrator reboiler BTU rating	Still vent VOC emissions per unit throughput values were derived by dividing annual uncontrolled dehydrator emissions by the annual gas throughput in MMSCF/yr. A throughput-based weighted average from all permits was used.
Heaters	Heater rating (MMBTU/hr)	A weighted average from various permits was used.
Compressors (wellhead and lateral)	Fraction of lean burn versus rich burn	OKDEQ provided an equipment inventory on compressor engines (minor sources) by basin; this inventory included equipment counts, engines characteristics such as size, rich vs. lean burn and data on controls. Fractions were estimated based on equipment counts and the categorization of interest.
	Controls: fraction of rich burn engines controlled by non-selective catalytic reduction; fraction of lean burn engines controlled by catalytic oxidizers	

In addition, Kansas and Oklahoma provided specific minor source permit data from their records to help gap-fill data fields for particular source categories. For example, condensate tanks and crude oil tanks emissions data (and emissions model runs if available) from permits were obtained to estimate an average VOC emissions factor for tank losses. E&P TANK model runs include the speciation of flash and post-flash gas streams that enabled estimation of HAPs emissions from tanks. Oklahoma also provided crucial data on minor source compressor engines that allowed for the derivation of data fields such as percent of compressors controlled, and fraction of lean burn versus rich burn.

Gas composition analyses for different gas venting/leaking points at well sites, such as produced gas, flash gas, and post-flash gas, were also extracted from permit applications, or provided directly by state agencies (Kansas) for specific basins. These were used to gap-fill any average gas compositions needed to estimate VOC and HAPs emissions from condensate/oil tanks flashing losses, tank unloading emissions, and other venting sources.

5.3 Literature Sources and Gap-Filling for Non-Surveyed Basins

Regionally-specific inputs that could not be derived from surveys or state minor source air permits were gap-filled with data from previous oil and gas emissions studies or, when considered necessary, using regional average values from survey data collected for other basins within CenSARA. This approach was used primarily but not exclusively for the low-tier source categories and for those basins that were not part of the survey outreach. ENVIRON and ERG reviewed existing sources of data in the literature on oil and gas activities and emission factors to fill in remaining data gaps in the inventory calculation inputs.

5.3.1 Reviewed literature

Literature was reviewed for information applicable to oil and gas activities in the CenSARA domain. Data sources were evaluated to determine which data were most suitable for filling data gaps either for selected source category/basin combinations or, in some cases, for all basins for a low-tier source category. Criteria used to determine the applicability of the literature data for the CenSARA oil and gas emissions inventory was based on: (1) the geographic scope of the study (2) temporal representativeness of the study and (3) quality/consistency of data as compared against other literature sources. The geographic scope was the most critical criteria for selection of the data as equipment/process characteristics, emissions rates, and gas compositions vary by region. For example, preliminary data from the Haynesville Shale 2011 Emissions Inventory Update (ENVIRON, 2012) was found to be the most relevant for certain source category estimates for the Louisiana-Mississippi Salt Flats Basin; the Haynesville Shale formation is located within the Salt Flats Basin and is where most of the basin-wide gas production is generated. Specific calculation inputs derived from the Haynesville Shale 2011 Emissions (Draft) Inventory are shown in Table 5-4, along with the other data resources that were reviewed and from which data inputs were derived in this study. When warranted, the temporal characteristic of the data source was considered as a selection criteria to insure that the most up-to-date data were applied in the calculations. Finally, data were evaluated for usefulness and consistency with similar oil and gas emissions inventory inputs and individual data points were either rejected or used based on ENVIRON's experience with previous oil and gas inventory development projects.

Table 5-4. Specific calculation inputs derived from literature sources.

Literature Source	Geographic Domain of Source	Source Category/Basin data was applied for	Data Field(s)
2011 Update of the Haynesville Shale Emissions Inventory (ENVIRON, 2012). *Draft Inventory as of October 2012*	Haynesville Shale formation within the Louisiana Mississippi Salt Flats basin	Wellhead Compressors/Salt Flats	Fraction of lean burn vs. rich burn; rated horsepower for lean burn engines; load factors
			Controls: % of rich burn engines controlled by non-selective catalytic reduction
		Drill Rigs (Horizontal)/Salt Flats	Total horsepower and hours of operation from a diesel-powered drill rig (includes all equipment in rig)
		Fracturing Pumps/Salt Flats	Engine horsepower and load factors
Recommendations for Improvements to the CENRAP States' Oil and Gas Emissions Inventories (Bar-Ilan, et al., 2008)	Central Region States	Drill Rigs/Permian	Vertical and horizontal drill rig configurations (total HP, load factors)
		Completion Well Venting/Permian	Venting rate (MCF/event)
		Heaters/OK, LA, TX basins	Numbers of heaters per well; heater BTU rating
		Fugitives/all basins	Number of devices per typical well
		Condensate Tanks/Permian	Controls: Fraction of tank throughput flared
EPA 2010 National Greenhouse Gas Inventory (EPA, 2012)	National average	Completion Well Venting/Sedgwick	Venting rate volume (MCF/event)
	National average	Heaters/Kansas basins	Numbers of heaters per well
	Midcontinent Region	Gas-actuated pneumatic Pumps/all basins	Methane venting rate per unit gas throughput, Methane venting rate per kimray pump, average no. pumps per well
	Midcontinent Region	Compressor seal fugitives/all basins	Methane leaking rate from compressor seals (SCF methane/hr/compressor)
	National average	Crude oil loading/all basins	Fraction of crude oil production delivered to refinery by truck
EPA Natural Gas Star Workshop on Plunger Lifts (EPA, 2006a)	National average	Blowdowns/Anadarko-Arkoma	Controls: Plunger lift control efficiency for liquids unloading
The Climate Registry Oil and Gas Production Annex II to the General Reporting Protocol (TRC, 2010)	National average	Water tanks/Permian and Salt Flats	Methane emissions factor for water tank losses at gas wells; methane emissions factors for water tanks at oil wells
		Mud degassing/all basins	Methane emissions factors for mud degassing; methodology

Literature Source	Geographic Domain of Source	Source Category/Basin data was applied for	Data Field(s)
EPA AP 42, Compilation of Air Pollutant Emission Factors, Fifth Edition (EPA, 1991; EPA, 1995; EPA, 1998; EPA, 2000; EPA, 2008)	National average	Compressor engines (wellhead and lateral)/all basins	Natural gas fired reciprocating engines emissions factors for rich burn and lean burn engines
		Artificial Lifts/all basins	Natural gas fired reciprocating engines emissions factors for rich burn engines for all pollutants of interest
		Flaring (all venting source categories)/all basins	Flaring emissions factors for all criteria pollutants, greenhouse gases and formaldehyde
		Heaters/all basins	External combustion natural gas-fired engines emissions factors
		Fugitives/all basins	TOC emissions factors for each equipment type by service type(kg/hr/component)
		Loading/all basins	Saturation factors and methodology for liquid loading emissions
NONROAD2008a emissions model (EPA, 2005)	CenSARA states average	Drill Rigs/all basins	CenSARA regional average emissions factors for 2011 for oil field equipment derived from EPA NONROAD2008 model
SPECIATE 4.0 (EPA, 2006b)	National average	Drill Rigs, Fracing Pumps, Flaring, Heaters/all basins	Speciation profiles for HAPs in combustion emissions from selected source categories
WRAP Phase III (WRAP, 2012)	Rocky Mountain Region	Drilling Rigs/Permian	Engine time of operation
		Crude Oil Tanks/Permian	VOC emissions factor (lbs-VOC/bbl)
			Controls: fraction of tank throughput flared
		Dehydrator/Permian	VOC emissions factor (lbs-VOC/MMSCF)

5.3.2 Inputs for emissions estimates of non-surveyed basins

Inventory development in this study was focused on characterizing to the best extent possible emissions and activity in the major oil and gas producing basins (based on 2011 production statistics) and on basins identified by CenSARA as being of special interest. Basin-specific data were collected via industry surveys and via review of minor source air permits as explained in previous sections. Part of the oil and gas activity data for most basins in Texas other than the Permian and the Marathon Thrust Belt were obtained from the Texas statewide oil and gas inventory and its associated emissions calculator tool previously developed by ERG (ERG, 2010). Data inputs for the following basins that were not included in the surveys were developed on a case by case basis:

- Bend Arch-Fort Worth Basin (TX, OK)

- Cherokee Platform (KS, OK)
- Denver Basin (NE)
- East Texas Basin (TX)
- Forest City Basin (MO, KS)
- Illinois Basin (MO, AR)
- Marathon Thrust Belt (TX)
- Nemaha Uplift (NE, KS, OK)
- Ozark Uplift (MO, AR)
- Palo Duro Basin (TX)
- Salina Basin (KS, NE)
- Southern Oklahoma (OK)
- Western Gulf (TX, LA)

For basins outside of Texas, such as Cherokee, Nemaha Uplift, Ozark Uplift, Salina, Southern Oklahoma, Denver, Forest City and Illinois, inputs for each emissions calculation field were developed based on regionally-specific averages (or equivalencies) of data used in other surveyed-basins' calculations. Averages were compiled differently for each non-surveyed basin based on what ENVIRON considered the most equivalent region (or mix of regions) to represent activity in the non-surveyed basin. For example, data fields for Denver basin were assumed to be similar to those of the Cambridge Arch. The averaging rules were applied consistently in each data field throughout all source categories in the inventory. Table 5-5 summarizes the averaging rules for input data for non-surveyed basins outside of Texas.

Table 5-5. Input data assumptions for non-surveyed basins outside of Texas (except Marathon Thrust Belt).

Non-surveyed basin	Inputs were developed as
Cherokee Platform	Activity data is the average of activity from surveyed basins (Anadarko, Cambridge, Arkoma, Permian and Louisiana Salt Flats)
Denver Basin	Activity data assumed similar to that of Cambridge Arch Basin
Forest City Basin	Activity data is the average of Cambridge and Sedgwick Basins' activity
Illinois Basin	Activity data assumed similar to that of Arkoma Basin
Marathon Thrust Belt	Activity data assumed similar to that of Permian Basin
Nemaha Uplift	Activity data is the average of Cambridge and Sedgwick Basins' activity
Ozark Uplift	Activity data is the average of activity from surveyed basins (Anadarko, Cambridge, Arkoma, Permian and Louisiana Salt Flats)
Salina Basin	Activity data assumed similar to that of Cambridge Arch Basin
Southern Oklahoma	Activity data is the average of Arkoma and Anadarko Basins' activity

Activity inputs in the Marathon Thrust Belt were assumed to be equivalent to those in the Permian Basin. For non-surveyed basins in Texas other than the Marathon Thrust Belt, input data for certain source categories were derived from previous oil and gas inventories prepared for or by the Texas Commission on Environmental Quality (TCEQ) as shown in Table 5-6

including the Texas Statewide Oil and Gas Inventory (ERG, 2010) which estimated 2008 county-level emissions for area sources in the upstream sector (on-shore). ERG collected county-level activity data, and specific emissions and emission factors data for each source category included in that inventory based on a variety of data sources, including existing databases (such as the Texas Railroad Commission (TRC) oil and gas production data), point source emissions inventory reports submitted to TCEQ (used for dehydrators), vendor data (used for compression engines and artificial lift engines), and published emission factor and activity data from the Houston Advanced Research Center (HARC), the Central Regional Air Planning Association (CENRAP), and the U.S. Environmental Protection Agency (EPA).

Table 5-6. Data sources used for calculation inputs for non-surveyed basins in Texas

Study and General Description	Author, Year	Notes
TCEQ's Characterization of Oil and Gas Production Equipment and Develop a Methodology to Estimate Statewide Emissions	ERG, 2010	Base year 2008 emissions inventory at the county-level for multiple oil and gas source categories. Includes emissions calculator tool for Texas basins.
TCEQ's Condensate Tank Oil and Gas Activities Study	ERG, 2012	Developed emissions factors and control factors for condensate storage tanks. Data is meant to be used for area source inventory development at the county-level for eight geographic regions in the TX.

Data from these studies were applied to Texas' basins using the methodologies developed for CenSARA to the extent possible. For those source categories that were not covered in previous Texas studies, calculation inputs were based on a regional average using data from surveyed-basins. State agencies may choose to gather the necessary data to update and provide more regionally specific inputs in the future.

6.0 EMISSIONS CALCULATOR TOOL DEVELOPMENT

6.1 Structure of Emissions Tool

The CenSARA Oil and Gas Emissions Calculations Tool is housed in a Microsoft Excel workbook. A separate workbook was developed for each state and is used to compile emissions for only that state. These are included in Electronic Appendix C. The Calculator Tool design is similar to the emissions calculator tool previously developed by ERG for the TCEQ but is more robust and flexible to accommodate the large amount of data developed in this study and the needs of each individual state. The Tool is structured to allow users to enter either county- or basin-specific information and review the calculated emissions. The "backbone" of the Tool consists of three main data sheets:

- Inputs_Activity: county-level production and drilling information. There are 783 counties within the CenSARA oil and gas region;
- Basin_Factors: basin-level factors that apply to variations in oil and natural gas activities across each basin. There are 19 basins within the CenSARA oil and gas region. Approximately 400 data parameters describe each basin and source category;
- Emission_Factors: applied to selected source categories, regardless of geographic level.

The information in the three main data sheets are actively linked to the SCC-specific emission calculation worksheets. In total, there are 34 worksheets representing 18 source categories. Table 6-1 presents the Source Categories and the applicable SCCs.

Table 6-1. Oil and gas emission source categories.

Source Category	SCC	SCC Shortened Description
ARTIFICIAL LIFT ENGINES	2310000330	Oil & Gas Expl & Prod /All Processes /Artificial Lift
BLOWDOWNS	2310021603	On-Shore Gas Production / Gas Well Venting - Blowdowns
CASINGHEAD GAS VENTING	2310011000	On Shore Crude Oil Production All Processes
CONDENSATE TANKS	2310021010	On-Shore Gas Production /Storage Tanks: Condensate
CRUDE OIL TANKS	2310010200	Oil & Gas Expl & Prod /Crude Petroleum /Oil Well Tanks - Flashing & Standing/Working/Breathing
DEHYDRATORS	2310021400	On-Shore Gas Production Dehydrators
DRILL RIGS	2310000220	Oil And Gas Exploration Drill Rigs
FUGITIVES	2310011501	On-Shore Oil Production /Fugitives: Connectors
FUGITIVES	2310011502	On-Shore Oil Production /Fugitives: Flanges
FUGITIVES	2310011503	On-Shore Oil Production /Fugitives: Open Ended Lines
FUGITIVES	2310011505	On-Shore Oil Production /Fugitives: Valves
FUGITIVES	2310021501	On-Shore Gas Production /Fugitives: Connectors
FUGITIVES	2310021502	On-Shore Gas Production /Fugitives: Flanges
FUGITIVES	2310021503	On-Shore Gas Production /Fugitives: Open Ended Lines
FUGITIVES	2310021505	On-Shore Gas Production /Fugitives: Valves
FUGITIVES	2310021506	On-Shore Gas Production /Fugitives: Other
GAS-ACTUATED PUMPS	2310111401	On-Shore Oil Exploration /Oil Well Pneumatic Pumps

Source Category	SCC	SCC Shortened Description
GAS-ACTUATED PUMPS	2310121401	On-Shore Gas Exploration: Gas Well Pneumatic Pumps
HEATERS	2310010100	On-Shore Oil Production /Heater Treater
HEATERS	2310021100	On-Shore Gas Production /Gas Well Heaters
HYDRAULIC FRACTURING	2310000660	Oil & Gas Expl & Prod /All Processes /Hydraulic Fracturing Engines
LATERAL/GATHERING LINE COMPRESSORS	2310021351	On-Shore Gas Production/Lateral Compressors 4 Cycle Rich Burn
LATERAL/GATHERING LINE COMPRESSORS	2310021251	On-Shore Gas Production/Lateral Compressors 4 Cycle Lean Burn
LOADING EMISSIONS	2310011201	On-Shore Oil Production /Tank Truck/Railcar Loading: Crude Oil
LOADING EMISSIONS	2310021030	On-Shore Gas Production /Tank Truck/Railcar Loading: Condensate
MUD DEGASSING	2310111100	On-Shore Oil Exploration /Mud Degassing
MUD DEGASSING	2310121100	On-Shore Gas Exploration /Mud Degassing
PNEUMATIC DEVICES	2310010300	Oil Production Pneumatic Devices
PNEUMATIC DEVICES	2310021300	On-Shore Gas Production Pneumatic Devices
PRODUCED WATER	2310000550	PRODUCED WATER
WELL COMPLETIONS	2310111700	On-Shore Oil Exploration: Oil Well Completion: All Processes
WELL COMPLETIONS	2310121700	On-Shore Gas Exploration: Gas Well Completion: All Processes
WELLHEAD COMPRESSOR ENGINES	2310021202	On-Shore Gas Production /Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP
WELLHEAD COMPRESSOR ENGINES	2310021302	On-Shore Gas Production /Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP

At the request of the technical team, three new SCCs were generated by EPA relating to specific source categories. They include:

- Tool Source Category: Hydraulic Fracturing
  - New SCC: 2310000660
  - SCC Shortened Description: Oil & Gas Expl & Prod /All Processes /Hydraulic Fracturing Engines
  - Comment: This SCC replaces 2270010010; while this is a valid SCC description (Diesel: Industrial Equipment: Other Oil Field Equipment (Drilling Rigs)), the SCC is under the NONROAD Sector, and would need to be submitted separately from the other Nonpoint source oil and natural gas source categories. To avoid generating two separate EIS submittal files, EPA created a new nonpoint SCC code to describe this emission source.
- Tool Source Category: Lateral/Gathering Compressors – 4-Cycle, Lean Burn
  - New SCC: 2310021251
  - SCC Shortened Description: On-Shore Gas Production/Lateral Compressors 4-Cycle Lean Burn

  - Comment: This SCC replaces 2310021209, which is “On-Shore Gas Production/ Total: All Natural Gas Fired 4-Cycle Lean Burn Compressor Engines”. This description is too general and not specific enough for this source category.
- Tool Source Category: Lateral/Gathering Compressors – 4-Cycle, Rich Burn
  - New SCC: 2310021351
  - SCC Shortened Description: On-Shore Gas Production/Lateral Compressors 4-Cycle Rich Burn
  - Comment: This SCC replaces 2310021309, which is “On-Shore Gas Production/ Total: All Natural Gas Fired 4-Cycle Rich Burn Compressor Engines”. This description is too general and not specific enough for this source category.

Each SCC worksheet follows the same general structure. The first nine columns contain descriptive information related to the emissions estimate, and are: FIPS, State abbreviation, County Name, Attainment status, Basin Name, SCC, SCC Shortened description, Source Category name, pollutant code. The next sets of fields are information extracted from the “Inputs_Activity” tab, such as: oil counts; gas completions; and horizontal drilling depth. The last grouping of information is for data fields extracted from the “Basin_Factors” tab, such as: hours of operation, molecular weight of the gas; and fraction of benzene in the VOC emissions.

The traditional nonpoint sources inventory contains activity data, emission factor, control information, and then emissions. Thus, after the last grouping of extracted information: 1) the activity data are populated or calculated; 3) the emission factor data are populated or calculated; and 3) the emissions are calculated. In each of the worksheets, the User has the ability to adjust emissions to avoid including point source emissions in the area source emissions total, and then a final nonpoint emission estimate is generated. Each workbook has a crosswalk of point sources to nonpoint sources SCCs which may be useful in entering the point source emissions adjustment.

There is also enhanced flexibility in adjusting inputs at the county- or basin-level, as well as color shading to assist the user with interpretation of data. The color shadings are as follows:

- Yellow: the user can overwrite the data in these cells;
- Red: point source activity adjustments can be made by the user. This is not recommended unless the adjustments cover all upstream oil and gas emissions that are currently included in the state’s point sources emissions inventory; and
- Orange: point source emission adjustments can be made by the User in each SCC worksheet.

6.2 Summary of methodologies used to estimate emissions for each source category

Emissions for individual oil and gas area source categories are developed following a bottom-up approach that begins with developing mass emission rates for each pollutant based on an activity surrogate (e.g. tons per well, tons per barrel of oil, tons per feet drilled). These by-surrogate emission rates are then scaled to county-level emissions by multiplying the emission rates by the scaling surrogate or activity from a particular county (e.g. gas well counts, horizontal feet drilled, crude oil production, etc.). Basin-level emissions are calculated as the sum of emissions from each county within the basin geographical limits.

Emissions calculations are performed within the Emissions Calculator Tool; data field names for calculation inputs are shown in a table at the end of each source category section in the same format and nomenclature as they would appear in the tool. Basin-specific input data for each source category calculation are located in the 'BASIN_FACTORS' and 'INPUTS_ACTIVITY' tabs of the tool which include emissions factors and equipment/activity factors for the various source categories. County-level production statistics, also referred to here as scaling surrogates (e.g. well counts, gas production, oil production, etc.), and other activity factors such as the fraction of gas wells with wellhead compressors are also located in the 'INPUTS_ACTIVITY' tab. Other input data referenced here may also be found in the 'EMISSION_FACTORS' tab, which contains average emission rates that were derived from the literature and are U.S. national default values (not regionally specific). Values in this tab are standard emissions rates generally defined by equipment properties or process characteristics, such as those for engine emissions, flaring emissions and by-component fugitives that do not typically vary by region . Therefore, venting emission rates, which are highly dependent on regional gas compositions, are not included in this tab but are instead included in the 'BASIN_FACTORS' tab.

The following sections describe emissions calculations for each source category; it is noted that some of these methodologies may apply to multiple SCCs and thus, are calculated separately in the individual sheets per SCC within the tool. The corresponding tab (calculation sheet) where each methodology is applied is included for reference.

6.2.1 Artificial Lifts

Calculation sheet: ARTIFICIAL_LIFTS_2310000330

Artificial lifts in this analysis refer specifically to engines located at oil wells that provide lift to the liquids in a well up to the wellhead. Generally, artificial lift engines such as pump jacks are small natural-gas fired engines similar to wellhead compressors. In the past decade there has been an increased use of electrified artificial lift engines powered by the grid; for this kind, emissions are assumed to be zero. The basic methodology for estimating emissions from a single non-electrified artificial lift engine is shown below:

Equation 1) $$E_{engine} = \frac{EF_i \times HP \times LF \times t_{annual}}{907{,}185}$$

where:

E_{engine} are emissions from an artificial lift engine [ton/year/engine]
EF_i is the emissions factor of pollutant *i* [g/hp-hr]
HP is the horsepower of the engine [hp]
LF is the load factor of the engine
t_{annual} is the annual number of hours the engine is used [hr/yr
907,185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

It is recommended that artificial lift engine emissions be scaled up to the county level on the basis of oil well counts. The methodology for scaling up artificial lift engine emissions is shown below:

Equation 2) $$E_{engine,TOTAL} = n \times E_{engine} \times f_{pumpjack} \times (1 - CF) \times W_{TOTAL}$$

where:

$E_{engine,TOTAL}$ is the total emissions from artificial lift engines in a county [ton/yr]
E_{engine} is the total emissions from an artificial lift engine (as shown in Equation 1) [ton/yr/engine]
n is the total number of artificial lift engines per well, generally equal to 1 (n=1) [engine/well]
W_{TOTAL} is the total number of **oil** wells in a county [wells]
$f_{pumpjack}$ is the fraction of oil wells with artificial lift engines
CF is the fraction of artificial lift engines that are electrified

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
FRACTION_ARTIFICIAL_ELECTRIC	Fraction of artificial lift engines that are electric	Unitless	BASIN_FACTORS
ARTIFICIAL_ENGINE_HP	Typical horsepower (HP) of an artificial lift engine	HP	BASIN_FACTORS
ARTIFICIAL_LOAD_FACTOR_LIFT_ENGINES	Typical load factor of an artificial lift engine	Unitless	BASIN_FACTORS
ARTIFICIAL_ANNUAL_ACTIVITY_HOURS	Typical number of hours operated for artificial lift engines	Hours per year	BASIN_FACTORS
EMISSION_FACTOR_NUMERATOR	Engine emissions factor for pollutant i	g/hp-hr	EMISSION_FACTORS
FRACT_OILWELLS_NEED_COMPRESSION	Fraction of oil wells with artificial lift engines	Unitless	INPUTS_ACTIVITY

6.2.2 Wellhead Compressor Engines

Calculation sheet(s): WELLHEAD_COMPRESSORS_2310021202; WELLHEAD_COMPRESSORS_2310021302

Wellhead compressor engines are generally small natural-gas fired engines located at the well site and used to boost produced gas pressure from downhole pressure to the required pressure for delivery to a transmissions pipeline. The fractional usage of these engines will depend on the basin characteristics; hence for those basins that largely require wellhead compression, this may be a significant area source of NOx emissions. Compressor engines found at a wellhead were categorized into two main categories in this analysis and thus emissions are estimated for each type of engine and consequently extrapolated to county-wide emissions. These categories of compressors are:

- Rich burn compressors
- Lean burn compressors

The basic methodology for estimating emissions from wellhead compressor engines is shown in Equation 3:

Equation 3) $$E_{engine,type} = \frac{EF_i \times HP \times LF \times t_{annual}}{907{,}185} \times (1 - F_{controlled} \times CF_i)$$

where:

E_{engine} are emissions from a particular type (rich vs. lean) of compressor engine [ton/year/engine]
EF_i is the emissions factor of pollutant *i* [g/hp-hr] (note that this may be different for NOx emissions from rich-burn vs. lean-burn engines)
HP is the horsepower of the engine [hp]
LF is the load factor of the engine
t_{annual} is the annual number of hours the engine is used [hr/yr]
$F_{controlled}$ is the fraction of compressors of a particular type (rich vs. lean) that are controlled
CF_i is the control factor for controlled engines for pollutant i
907,185 is the unit conversion factor g/ton

<u>Extrapolation to county-level emissions</u>

County-level emissions are made up of the combination of emissions from each type of wellhead compressor, rich burn and lean burn. Emissions are scaled to county level using the usage fraction (C) of each engine type against all other compressor engines, the fraction of wells with wellhead compressor engines, and the total gas well count in a county, according to equation below:

Equation 4) $$E_{engine,TOTAL} = \left(C_{rich}E_{engine,rich} + C_{lean}E_{engine,lean}\right) \times W_{TOTAL} \times f_{wellhead}$$

where:

$E_{engine,TOTAL}$ is the total emissions from compressor engines in a county [ton/yr]
$E_{engine,lean}$ is the total emissions from a single lean burn compressor engine per Equation (3) [ton/yr]
$E_{engine,rich}$ is the total emissions from a single rich burn compressor engine per Equation (3) [ton/yr]
C_{lean} is the fraction of lean-burn wellhead compressors in the basin amongst all wellhead compressors
C_{rich} is the fraction of rich-burn wellhead compressors in the basin amongst all wellhead compressors
W_{TOTAL} is the total **gas** well count in a county
$f_{wellhead}$ is the fraction of all **gas** wells in the basin with wellhead compressor engines

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
EMISSION_FACTOR_NUMERATOR	Engine emissions factor for pollutant i	g/hp-hr	EMISSION_FACTORS
FRACTION_RICH_BURN	Fraction of wellhead compressor engines that are rich-burn	Unitless	BASIN_FACTORS
FRACTION_LEAN_BURN	Fraction of wellhead compressor engines that are lean-burn	Unitless	BASIN_FACTORS
LEAN_BURN_LOAD_FACTOR	Typical load factor of a lean-burn wellhead compressor engine	Unitless	BASIN_FACTORS
RICH_BURN_LOAD_FACTOR	Typical load factor of a rich-burn wellhead compressor engine	Unitless	BASIN_FACTORS
LEAN_BURN_CONTROLLED	Fraction of wellhead lean-burn compressor engines that are controlled	Unitless	BASIN_FACTORS
RICH_BURN_CONTROLLED	Fraction of wellhead rich-burn compressor engines that are controlled	Unitless	BASIN_FACTORS
LEAN_BURN_HP	Typical horsepower (HP) of a lean-burn wellhead compressor engine	HP	BASIN_FACTORS
RICH_BURN_HP	Typical horsepower (HP) of a rich-burn wellhead compressor engine	HP	BASIN_FACTORS
ANNUAL_ACTIVITY_HR	Typical number of hours operated for wellhead compressor engines	Hours per year	BASIN_FACTORS
FRACT_GASWELLS_NEED_COMPRESSION	Fraction of gas wells needing wellhead compression, HPDI Database or Survey Data	Unitless	INPUTS_ACTIVITY

6.2.3 Lateral/Gathering Compressor Engines

Calculation sheet(s): LATERAL_COMPRESSORS_2310021351; LATERAL_COMPRESSORS_2310021251

Lateral compressor engines are used to gather gas from multiple individual wells, generally serving groups of approximately 10 to 100 wells. These engines are generally medium size and larger than wellhead compressor engines, but often not large enough to trigger Title V or other major source permitting requirements. Lateral compressor engines were categorized into two main categories and thus emissions are estimated for each type of engine and consequently extrapolated to county-wide emissions. These categories of compressors are:

- Rich burn compressors
- Lean burn compressors

The basic methodology for estimating emissions from lateral compressor engines is shown in Equation 5:

Equation 5)
$$E_{engine,type} = \frac{EF_i \times HP \times LF \times t_{annual}}{907{,}185} \times (1 - F_{controlled} \times CF_i)$$

where:

$E_{engine,type}$ are emissions from a particular type (rich vs. lean) of compressor engine [ton/year/engine]
EF_i is the emissions factor of pollutant *i* [g/hp-hr] (note that this value may be differ between rich-burn vs. lean-burn engines)
HP is the horsepower of the engine [hp]
LF is the load factor of the engine
t_{annual} is the annual number of hours the engine is used [hr/yr]
$F_{controlled}$ is the fraction of lateral compressors of a particular type that are controlled
CF_i is the control factor for controlled engines for pollutant i
907,185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

County-level emissions are represented by a mix of the two types of lateral compressors. Single engine emissions are scaled to county level using the fraction (C) of these engine types to total engines, the fraction of wells served by lateral compressor engines, and the total gas well count in a county, according to equation below:

Equation 6)
$$E_{engine,TOTAL} = \left(C_{rich} E_{engine,rich} + C_{lean} E_{engine,lean}\right) \times W_{TOTAL} \times \frac{1}{N_{lateral}}$$

where:

$E_{engine,TOTAL}$ is the total emissions from compressor engines in a county [ton/yr]
$E_{engine,lean}$ is the total emissions from a single lean burn compressor engine per Equation (5) [ton/yr]
$E_{engine,rich}$ is the total emissions from a single rich burn compressor engine per Equation (5) [ton/yr]
C_{lean} is the fraction of lean-burn lateral compressors in the basin amongst all lateral compressors
C_{rich} is the fraction of rich-burn lateral compressors in the basin amongst all lateral compressors
W_{TOTAL} is the total **gas** well count in a county
$N_{lateral}$ is the number of gas wells served by a lateral compressor engine

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
EMISSION_FACTOR_NUMERATOR	Engine emissions factor for pollutant i	g/hp-hr	EMISSION_FACTORS
LATERAL_HRS_OPERATION	Typical number of hours operated for lateral/gathering compressor engines	Hours per year	BASIN_FACTORS
LATERAL_NUM_WELLS_PER_LINE	No. wells served by single lateral compressor	Wells per compressor	BASIN_FACTORS
LATERAL_FRACT_RICH	Fraction of lateral compressors that are rich-burn	Unitless	BASIN_FACTORS
LATERAL_FRACT_LEAN	Fraction of lateral compressors that are lean-burn	Unitless	BASIN_FACTORS
LATERAL_LEAN_HP	Typical horsepower (HP) of a lean-burn lateral compressor engine	HP	BASIN_FACTORS
LATERAL_RICH_HP	Typical horsepower (HP) of a rich-burn lateral compressor engine	HP	BASIN_FACTORS
LATERAL_LEAN_LOAD_FACT	Typical load factor of a lean-burn lateral compressor engine	Unitless	BASIN_FACTORS
LATERAL_RICH_LOAD_FACT	Typical load factor of a rich-burn lateral compressor engine	Unitless	BASIN_FACTORS
LATERAL_LEAN_ENGINE_CONT_FRAC	Fraction of lean-burn lateral compressor engines that are controlled	Unitless	BASIN_FACTORS
LATERAL_RICH_ENGINE_CONT_FRAC	Fraction of rich-burn lateral compressor engines that are controlled	Unitless	BASIN_FACTORS

6.2.4 Condensate tanks

Calculation sheet: CONDENSATE_TANKS_2310021010

Condensate storage tanks are considered a significant source of VOC emissions. Tank losses are generated by flashing and by working and breathing processes, although generally the emissions are dominated by flashing losses. This analysis uses a combined-losses emissions factor and assumes that the gas compositions from both processes are identical. The methodology for estimating condensate tank combined losses is shown below:

Equation 7) $$E_{condensate,\tan ks,VOC} = \frac{EF_{condensate,tanks,VOC}}{2000} \times \left[1 - F \times C_{captured} \times C_{efficiency}\right]$$

where:

$E_{condensate,tanks,VOC}$ is the VOC emissions per liquid unit throughput from condensate tanks [tons/bbl]
$EF_{condensate,tanks,VOC}$ is the VOC emissions factor for combined losses from condensate tanks [lb-VOC/bbl]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of condensate tanks with flares
2000 is the unit conversion factor lb/ton

The methodology for estimating condensate tank combined losses from other pollutants i in the flashing gas is shown below:

Equation 8) $$E_{condensate,tanks,i} = E_{condensate,tanks,VOC} \times \frac{weight\ fraction_i}{weight\ fraction_{VOC}}$$

where:

$E_{condensate,tanks,i}$ is the emissions of pollutant i per liquid unit throughput from condensate tanks [tons/bbl]
$E_{condensate,tanks,VOC}$ is the VOC emissions per liquid unit throughput from condensate tanks [tons-VOC/bbl]
weight fraction is the mass-based concentration of pollutant i and VOC in the flashing gas

Flaring emissions from condensate tank controls

This source category includes any flaring emissions associated with controls applied to condensate tanks. The methodology for estimating emissions from flaring of condensate tank flash gas is described below:

Equation 9)

$$E_{flare,tank,i} = P_{county} \times \left(Q_{condensate,tanks} \times F \times \left(C_{captured} \right) \times \left(C_{efficiency} \right) \times \frac{EF_i \times HV}{1000} \right) \Big/ 2000$$

where:

$E_{flare,tank,i}$ is the county-wide flaring emissions of pollutant i from condensate tank controls [ton/yr]
$Q_{condensate,tank}$ is the uncontrolled volume of tank losses vented per unit of condensate throughput [MCF/bbl]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of condensate tanks with flares
EF_i is the flaring emissions factor for pollutant i [lb/MMBtu]
HV is the local heating value of the gas [BTU/SCF]
P_{county} is the annual throughput of condensate production in the county [bbl/yr]
2000 is the unit conversion factor lb/ton
1000 is the unit conversion factor MCF/MMCF

The methodology for estimating SO_2 emissions from flaring of oil and condensate flash gas is shown below:

Equation 10)

$$E_{flare,tank,SO_2} = \left(\frac{P \times \left(Q_{condensate,tank} \times F \times \left(C_{captured} \right) \times \left(C_{efficiency} \right) \times P_{county} \right)}{\left(R \big/ MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times f_{H_2S} \times 2 \big/ 907185$$

where:

$E_{flare,tank,SO_2}$ is the county-wide SO_2 flaring emissions from condensate tanks controls [ton/yr]
P is atmospheric pressure [1 atm]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the flash gas [g/mol]
T is the atmospheric temperature [298 K]
f_{H_2S} is the mass fraction of H_2S in the flash gas
$Q_{condensate,tank,}$ is the uncontrolled volume of tank losses vented per unit of condensate throughput [MCF/bbl]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of condensate tanks with flares

P_{county} is the annual throughput of condensate production county-wide [bbl/yr]
$3.5x10^{-5}$ is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

To estimate county-wide total condensate tank emissions, which includes venting and flaring, for each pollutant i, Equation 11 below is used:

Equation 11) $$E_{cond.\tan ks,TOTAL} = E_{condensate,\tan ks,i} \times P + E_{flare,\tan k,i}$$

where

$E_{cond.tanks,TOTAL}$ is the county-wide total emissions for pollutant i from condensate tanks [tons/yr]
$E_{condensate,tanks,i}$ is the combined losses of pollutant i per liquid unit throughput from condensate tanks [tons/bbl]
P is the annual production of condensate county-wide [bbl/yr]
$E_{flare,tank,i}$ is the county-wide flaring emissions of pollutant i from condensate tank controls [ton/yr]

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
COND_TANK_FRAC_TO_TANKS	Fraction of condensate directed to tanks	Unitless	BASIN_FACTORS
COND_TANK_FLARE_FRAC	Fraction of condensate tanks with a flare	Unitless	BASIN_FACTORS
COND_TANK_FLASH_GAS_VOC_FRAC	VOC fraction of the flash gas	Unitless	BASIN_FACTORS
COND_TANK_FLARE_CAPT_EFF	Capture Efficiency of the flare	Unitless	BASIN_FACTORS
COND_TANK_FLARE_CONT_EFF	Control Efficiency of the flare	Unitless	BASIN_FACTORS
COND_TANK_AVG_FLASH_LOSSES	Flashing emission factor VOC lost per barrel (BBL) of condensate throughput	LB VOCS/BBL	BASIN_FACTORS
COND_TANK_AVG_WORK_BREATH_LOSS	Working/Breathing emission factor VOC lost per barrel (BBL) of condensate throughput	LB VOCS/BBL	BASIN_FACTORS
COND_TANKS_NUM_PER_WELL	Number of condensate tanks per well	COUNT	BASIN_FACTORS
COND_TANK_VOC_LOSS_THROUGHPUT	Emission factor of VOC per barrel (BBL) of condensate throughput	LB VOC/BBL	BASIN_FACTORS
COND_TANK_FLASH_GAS_VENTING_RAT E	Volume of flash gas vented per BBL of condensate throughput	MCF/BBL	BASIN_FACTORS
COND_TANK_LOCAL_HV	Heating value of the flared gas at the condensate tank	BTU/SCF	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
COND_TANK_FRACT_H2S	Fraction of hydrogen sulfide in the flared gas at the condensate tank	Unitless	BASIN_FACTORS
COND_TANK_MW_GAS	Molecular weight of the flash gas being flared at the condensate tank	G/MOL	BASIN_FACTORS
COND_TANK_FACTOR_CH4_VOC	Methane ratio to VOC being emitted from condensate storage tanks	Unitless	BASIN_FACTORS
COND_TANK_FACTOR_BENZ_VOC	Benzene fraction of VOC being emitted from condensate storage tanks	Unitless	BASIN_FACTORS
COND_TANK_FACTOR_ETHYLBENZ_VOC	Ethylbenzene fraction of VOC being emitted from condensate storage tanks	Unitless	BASIN_FACTORS
COND_TANK_FACTOR_TOLUENE_VOC	Toluene fraction of VOC being emitted from condensate storage tanks	Unitless	BASIN_FACTORS
COND_TANK_FACTOR_XYLENE_VOC	Xylene fraction of VOC being emitted from condensate storage tanks	Unitless	BASIN_FACTORS

6.2.5 Dehydrators

Calculation sheet: DEHYDRATORS_2310021400

In the current analysis, this source category refers to wellhead dehydrator units. Dehydrator units are used to remove excess water from produced natural gas prior to delivery to the pipeline or to a gas processing plant. Two main sources of emissions are found in a dehydrator device: hydrocarbon emissions (including VOC, HAPs, CH_4) are generated in the dehydrator still vent, and combustion emissions are generated in the dehydrator reboiler. In addition, if dehydrator still vents are controlled by flare, combustion emissions from flaring controls contribute to the total dehydrator emissions. The basic methodology for estimating county-wide emissions from dehydrator still vents is shown in Equation 12:

Equation 12) $$E_{stillvent,VOC} = P \times \frac{EF_{stillvent}}{1000 \times 2000} \times \left[1 - F \times C_{captured} \times C_{efficiency}\right]$$

where:

$E_{stillvent,VOC}$ is the county-wide VOC emissions from dehydrator still vents [ton/yr]
$EF_{stillvent}$ is the VOC emission factor for dehydrator still vent per unit of gas throughput [lb-VOC/MMSCF]
P is the annual county-wide throughput of gas (gas production) [MCF/yr]
F is the fraction of dehydrator vents with flares

$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
2000 is the unit conversion factor lb/ton
1000 is the unit conversion factor MCF/MMCF

The methodology for estimating dehydrator still vent emissions from other pollutants i is shown below

Equation 13) $$E_{stillvent,i} = E_{stillvent,VOC} \times \frac{weight\ fraction_i}{weight\ fraction_{VOC}}$$

where:

$E_{stillvent,i}$ is the county-wide emissions of pollutant i from dehydrator still vents [ton/yr]
$E_{stillvent,VOC}$ is the county-wide VOC emissions from dehydrator still vents [ton/yr]
weight fraction is the mass-based concentration of pollutant i or VOC in the vented gas

The basic methodology for estimating emissions for the dehydrator reboiler is equivalent to that of a standard field heater:

Equation 14) $$E_{reboiler,\ i} = N \times \frac{EF_i \times Q_{reboiler} \times t_{annual} \times hc}{HV_{local} \times 1.10^6 \times 2000} \times W$$

where:

$E_{reboiler,i}$ is the county-wide emissions from pollutant i from dehydrator reboilers [ton/yr]
EF_i is the emission factor for pollutant i for natural gas-fired small boilers [lb/MMSCF]
$Q_{reboiler}$ is the heater size [Btu/hr]
HV_{local} is the local natural gas heating value [Btu_{local}/SCF]
t_{annual} is the annual hours of operation [hr]
hc is a heater cycling fraction of operating hours that the heater is firing
N is the number of dehydrators per well [1/well]
W is the county-wide number of active **gas** wells in a particular year [well/yr]
2000 is the unit conversion factor lb/ton
1.10^6 is the unit conversion factor SCF/MMSCF

Flaring emissions from dehydrator venting controls

The methodology for estimating county-wide emissions from flaring of dehydrator still vent gas is described below

Equation 15)

$$E_{flare,dehy,i} = \left(G \times Q_{dehydrator,vent} \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right) \times \frac{EF_i \times HV}{10^6} \right) \Big/ 2000$$

where:

$E_{flare,dehy}$ is the county-wide emissions of pollutant i from dehydrator vent gas flaring [ton/yr]
$Q_{dehydrator,vent}$ is the volume of gas flared per unit of gas throughput in dehydrator [MCF vented/MMSCF natural gas]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of dehydrators with flares
EF_i is the flaring emissions factor for pollutant i [lb/MMBtu]
HV is the local heating value of the gas [BTU/SCF]
G is the county-wide gas production [MMSCF/yr]
2000 is the unit conversion factor lb/ton
1.10^6 is the unit conversion factor SCF/MMSCF

The methodology for estimating SO_2 emissions from flaring of dehydrator vent gas is shown below

Equation 16)

$$E_{flare,dehydrator,SO_2} = P \times \left(\frac{G \times Q_{dehydrator,vent} \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right)}{\left(R / MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times f_{H_2S} \times 2/907185$$

where:

$E_{flare,dehydrator,SO_2}$ is the county-wide SO_2 flaring emissions from flaring of dehydrator vent gas [ton/yr]
P is atmospheric pressure [1 atm]
$Q_{dehydrator,vent}$ is the volume of gas flared per unit of gas throughput [MCF vented/MMSCF natural gas]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of dehydrators with flares
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the dehydrator venting gas [g/mol]
T is the atmospheric temperature [298 K]
f_{H_2S} is the mass fraction of H_2S in the dehydrator venting gas
G is the county-wide gas production [MMSCF/yr]
$3.5x10^{-5}$ is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

Equations 12-16 provide direct county-level estimates of pollutant emissions from dehydrator still vents, reboilers, and flaring controls. Emissions of the same pollutant each of these three sub-categories should be added together to arrive at total county-level dehydrator emissions (still vent + reboiler + flaring).

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
DEHYD_FRACT_FLARES	Fraction of dehydrators with flares	Unitless	BASIN_FACTORS
DEHYD_STILL_VENT_VOC_EF	VOC Stillvent emission factor	LB VOC/MMSCF	BASIN_FACTORS
DEHYD_REBOILER_RATING	Heater size rating	BTU/HR	BASIN_FACTORS
DEHYD_LHV	Heating value of the natural gas used for fuel	BTU/SCF	BASIN_FACTORS
DEHYD_OP_HRS	Typical number of hours operated for the reboiler	Hours per year	BASIN_FACTORS
DEHYD_HEATING_CYCLE	Fraction to account for the fraction of operating hours that the heater is firing	Unitless	BASIN_FACTORS
DEHYD_NUM_PER_WELL	Number of dehydrators per well	COUNT/WELL	BASIN_FACTORS
DEHYD_VOL_GAS_FLARED_THROUGHPUT	Volume of gas flared per unit of natural gas throughput	MCF/MMSCF	BASIN_FACTORS
DEHYD_VOC_FRACT_FLARE_GAS	VOC fraction in the Flared Gas	Unitless	BASIN_FACTORS
DEHYD_H2S_FRACT_FLARE_GAS	Hydrogen sulfide fraction in the Flared Gas	Unitless	BASIN_FACTORS
DEHYD_MW	Molecular weight of the flared gas	G/MOL	BASIN_FACTORS
DEHYD_FLARING_CAPTURE_EFF	Capture Efficiency of the flare	Unitless	BASIN_FACTORS
DEHYD_FLARING_CONTROL_EFF	Control Efficiency of the flare	Unitless	BASIN_FACTORS
DEHYD_STILL_VENT_CH4_VOC	Methane ratio to VOC being emitted from dehydrator still vent	Unitless	BASIN_FACTORS
DEHYD_STILL_VENT_BENZ_VOC	Benzene ratio to VOC being emitted from dehydrator still vent	Unitless	BASIN_FACTORS
DEHYD_STILL_VENT_ETHYLBENZ_VOC	Ethylbenzene ratio to VOC being emitted from dehydrator still vent	Unitless	BASIN_FACTORS
DEHYD_STILL_VENT_TOLEUNE_VOC	Toluene ratio to VOC being emitted from dehydrator still vent	Unitless	BASIN_FACTORS
DEHYD_STILL_VENT_XYLENE_VOC	Xylene ratio to VOC being emitted from dehydrator still vent	Unitless	BASIN_FACTORS

6.2.6 Drilling Rigs

Calculation sheet: DRILL_RIGS_2310000220

Drilling rig emissions considered three primary engines: Draw works, Mud pumps and Generators. Each of these three engine types is used for differing periods of time throughout the drilling process and are likely to have different load factor and sizes. Each of the three engines is also likely to be of differing model years and hence Tier levels. Some drilling rigs operate with a set of large generator engines which provides electric power to the other prime movers of the rig – draw works and mud pumps; these type of rigs are referred to here as diesel-electric rigs. In order to account for variations in engine characteristics and their effect in final emissions, average emissions for each type of engine *k* (k=drawworks, mum pumps or generators) is estimated separately. In addition, operation parameters such as time and load factor vary for vertical wellbores and horizontal wellbores; hence emissions were estimated separately for both drilling methods using equation 17 and 18.

Emissions for a single engine of type k are estimated according to Equation 17:

Equation 17) $$E_{engine\ k,i} = \frac{EF_i \times HP_k \times LF_k \times t_{event} \times n}{907{,}185}$$

where:

- $E_{engine\ k,i}$ are emissions of pollutant *i* from an engine type k [ton/spud]
- EF_i is the average emissions factor of pollutant *i* [g/hp-hr]
- HP_k is the average horsepower for an engine k in the basin [hp]
- LF_k is the average load factor of the engine k
- t_{event} is the number of hours engine k is used [hr/spud]
- *907,185* is the mass unit conversion [g/ton]
- *n* is the number of type-k engines in the typical drill rig

The emission factor for pollutant i, EF_i, is an average emissions factor derived from EPA's NONROAD2008 model and based on the representative population of drilling engine of various tier levels in NONROAD. The emissions factor for drill-rig equipment varies by horsepower range, and there are three possible horsepower bins applicable to the typical range of equipment sizes for drill rig engines. Hence, three sets of possible engine emissions factors (by HP) are used.

Emissions from a single drill rig $(E_{drillrigTOTAL,i})$ are estimated in Equation 18 as the sum of individual emissions from each drill rig engine as calculated with Equation 17 in [tons/spud]:

Equation 18) $$E_{drillrigTOTAL,i} = \sum E_{engine\ k,i}$$

Two distinct drill-rigs configurations may be found in various basins:

- Diesel-mechanical (D) drill rigs: in which all *k* engines are diesel-fueled

- Diesel-electric (DE) powered drill rigs: in which only the generator is powered by diesel and the draw works and mud pumps are electric (and thus do not have direct emissions associated with them)

Thus equations 17 and 18 will vary by these two configurations, and a set of input values for each the four combinations of vertical/horizontal wellbores and diesel/diesel-electric rigs must be applied.

Emissions from drill rigs correlate to the depth of the wellbore, which will vary between horizontal and vertical wellbores; thus emissions can be estimated on a "per foot drilled' basis using the equation below

Equation 19)

$$\left[E_{drilling,i}\right]_{vertical/horizontal} = \left[\frac{E_{drillrigTOTAL,i_D} \times (1-F_{DE}) + E_{drillrigTOTAL,i_{DE}} \times F_{DE}}{D_{spud}}\right]_{\frac{vertical}{horizontal}}$$

where

$E_{drilling,i}$ is the total emissions for a horizontal or vertical spud per unit of feet drilled [tons/ft]
$E_{drillrigTOTAL,i_D}$ is the emissions from a single diesel-powered drill rig (from Equation 18) for a vertical or a horizontal spud [tons/spud]
$E_{drillrigTOTAL,i_{DE}}$ is the emissions from a single diesel-electric drill rig (from Equation 18) for a vertical or a horizontal spud [tons/spud]
F_{DE} is the fraction of drill rigs that are diesel-electric
D_{spud} is the average depth of a vertical or horizontal spud [ft/spud]

<u>Extrapolation to county-level emissions</u>

Emissions per feet drilled are scaled to county-level drilling emissions according to Equation 20

Equation 20)

$$E_{drill,county-wide,i} = \left[E_{drilling,i}\right]_{vertical} \times D_{vertical} + \left[E_{drilling,i}\right]_{horizontal} \times D_{horizontal}$$

where:

$E_{drill,county\text{-}wide,i}$ is the total emissions of pollutant i from county-wide drilling activity [tons/yr]
$E_{drilling,i}$ is the total emissions from drilling a single well [tons/ft]
$D_{vertical}$ is the total depth drilled in the county for vertical wells in a particular year [ft/r]
$D_{horizontal}$ is the total depth drilled in the county for horizontal wells in a particular year [ft/yr]

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
DRILL_FRACT_DIESEL_ELECTRIC	Fraction of drill-rigs that are diesel-electric	Unitless	BASIN_FACTORS
DRILL_HORIZ_DEPTH_SPUD	Average depth per spud, horizontal drilling	FT/SPUD	BASIN_FACTORS
DRILL_HORIZ_SPUD_DURATION	Average duration per spud, horizontal drilling	HR	BASIN_FACTORS
DRILL_HORIZ_FUEL_CONSUMED	Average fuel consumed, horizontal drilling	GALLONS	BASIN_FACTORS
DRILL_HORIZ_DRAW_HP	Average horsepower for draworks, horizontal drilling	HP	BASIN_FACTORS
DRILL_HORIZ_DRAW_LOAD_FACTOR	Average load factor for draworks, horizontal drilling	Unitless	BASIN_FACTORS
DRILL_HORIZ_DRAW_NUM_ENGINES_RIG	Average number of engines per rig for draworks, horizontal drilling	COUNT/RIG	BASIN_FACTORS
DRILL_HORIZ_DRAW_HRS_SPUD	Average number of engines hours per spud for draworks, horizontal drilling	HR/SPUD	BASIN_FACTORS
DRILL_HORIZ_MUD_PUMPS_HP	Average horsepower for mud pumps, horizontal drilling	HP	BASIN_FACTORS
DRILL_HORIZ_MUD_PUMPS_LOAD_FACTOR	Average load factor for mud pumps, horizontal drilling	Unitless	BASIN_FACTORS
DRILL_HORIZ_MUD_PUMPS_NUM_ENGINES_RIG	Average number of engines per rig for mud pumps, horizontal drilling	COUNT/RIG	BASIN_FACTORS
DRILL_HORIZ_MUD_PUMPS_HRS_SPUD	Average number of engines hours per spud for mud pumps, horizontal drilling	HR/SPUD	BASIN_FACTORS
DRILL_HORIZ_GEN_DIESEL_HP	Average horsepower for diesel rigs, horizontal drilling	HP	BASIN_FACTORS
DRILL_HORIZ_GEN_DIESEL_LOAD_FACTOR	Average load factor for diesel rigs, horizontal drilling	Unitless	BASIN_FACTORS
DRILL_HORIZ_GEN_DIESEL_NUM_ENGINES_RIG	Average number of engines per rig for diesel rigs, horizontal drilling	COUNT/RIG	BASIN_FACTORS
DRILL_HORIZ_GEN_DIESEL_HRS_SPUD	Average number of engines hours per spud for diesel rigs, horizontal drilling	HR/SPUD	BASIN_FACTORS
DRILL_HORIZ_GEN_DIESEL_ELEC_HP	Average horsepower for diesel-electric rigs, horizontal drilling	HP	BASIN_FACTORS
DRILL_HORIZ_GEN_DIESEL_ELEC_LOAD_FACTOR	Average load factor for diesel-electric rigs, horizontal drilling	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
DRILL_HORIZ_GEN_DIESEL_ELEC_NUM_ENGINES_RIG	Average number of engines per rig for diesel-electric rigs, horizontal drilling	COUNT/RIG	BASIN_FACTORS
DRILL_HORIZ_GEN_DIESEL_ELEC_HRS_SPUD	Average number of engines hours per spud for diesel-electric rigs, horizontal drilling	HR/SPUD	BASIN_FACTORS
DRILL_VERT_DEPTH_SPUD	Average depth per spud, vertical drilling	FT/SPUD	BASIN_FACTORS
DRILL_VERT_SPUD_DURATION	Average duration per spud, vertical drilling	HR	BASIN_FACTORS
DRILL_VERT_FUEL_CONSUMED	Average fuel consumed, vertical drilling	GALLONS	BASIN_FACTORS
DRILL_VERT_DRAW_HP	Average horsepower for draworks, vertical drilling	HP	BASIN_FACTORS
DRILL_VERT_DRAW_LOAD_FACTOR	Average load factor for draworks, vertical drilling	Unitless	BASIN_FACTORS
DRILL_VERT_DRAW_NUM_ENGINES_RIG	Average number of engines per rig for draworks, vertical drilling	COUNT/RIG	BASIN_FACTORS
DRILL_VERT_DRAW_HRS_SPUD	Average number of engines hours per spud for draworks, vertical drilling	HR/SPUD	BASIN_FACTORS
DRILL_VERT_MUD_PUMPS_HP	Average horsepower for mud pumps, vertical drilling	HP	BASIN_FACTORS
DRILL_VERT_MUD_PUMPS_LOAD_FACTOR	Average load factor for mud pumps, vertical drilling	Unitless	BASIN_FACTORS
DRILL_VERT_MUD_PUMPS_NUM_ENGINES_RIG	Average number of engines per rig for mud pumps, vertical drilling	COUNT/RIG	BASIN_FACTORS
DRILL_VERT_MUD_PUMPS_HRS_SPUD	Average number of engines hours per spud for mud pumps, vertical drilling	HR/SPUD	BASIN_FACTORS
DRILL_VERT_GEN_DIESEL_HP	Average horsepower for diesel rigs, vertical drilling	HP	BASIN_FACTORS
DRILL_VERT_GEN_DIESEL_LOAD_FACTOR	Average load factor for diesel rigs, vertical drilling	Unitless	BASIN_FACTORS
DRILL_VERT_GEN_DIESEL_NUM_ENGINES_RIG	Average number of engines per rig for diesel rigs, vertical drilling	COUNT/RIG	BASIN_FACTORS
DRILL_VERT_GEN_DIESEL_HRS_SPUD	Average number of engines hours per spud for diesel rigs, vertical drilling	HR/SPUD	BASIN_FACTORS
DRILL_VERT_GEN_DIESEL_ELEC_HP	Average horsepower for diesel-electric rigs, vertical drilling	HP	BASIN_FACTORS
DRILL_VERT_GEN_DIESEL_ELEC_LOAD_FACTOR	Average load factor for diesel-electric rigs, vertical drilling	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
DRILL_VERT_GEN_DIESEL_ELEC_NUM_ENGINES_RIG	Average number of engines per rig for diesel-electric rigs, vertical drilling	COUNT/RIG	BASIN_FACTORS
DRILL_VERT_GEN_DIESEL_ELEC_HRS_SPUD	Average number of engines hours per spud for diesel-electric rigs, vertical drilling	HR/SPUD	BASIN_FACTORS

6.2.7 Pneumatic Devices

Calculation Sheet: PNEUMATIC_GASWELL_2310021300; PNEUMATIC_OILWELL_2310010300

Pneumatic devices are control devices located at the well site that are powered pneumatically by high-pressure produced gas. These devices are typically under operation throughout the year and they may or may not vent the working fluid during operation, making them a potentially significant source of VOC emissions. The counts of pneumatic devices vary between oil and gas wells, thus emissions were estimated separately for both well types. Emissions from pneumatic devices vary by the bleed rate of the device. Here it is assumed that four configurations can be found in a typical well: high bleed, low bleed, intermittent and no bleed. Emissions for the first three types of device *i* must be determined. The methodology for estimating the emissions from pneumatic devices for a particular type of well are shown in Equation 21:

Equation 21) $$E_{pneumatic,j} = \frac{f_j}{907185}\left(\sum_i \dot{V}_i \times N_i \times t_{annual}\right) \times \frac{P}{1000 \times \left(\left(R/MW_{gas}\right) \times T \times 3.5 \times 10^{-5}\right)}$$

where:

$E_{pneumatic,j}$ is the total emissions of pollutant *j* from all pneumatic devices for a particular type of well (oil vs. gas) [ton/year/well]
$\dot{V}_i$ is the volumetric bleed rate from device *i* [SCF/hr/device]
N_i is the average number of devices *i* found in a type of well (oil vs. gas) [devices/well]
t_{annual} is the number of hours per year that devices were operating [8760 hr/yr]
P is the atmospheric pressure [1 atm]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
T is the atmospheric temperature [298 K]
f_j is the mass fraction of pollutant *j* in the vented gas (produced gas)
3.5×10^{-5} is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton
1000 is the unit conversion factor SCF/MCF

Extrapolation to county-level emissions

County-wide pneumatic device emissions for each well type were estimated according to Equation 22:

Equation 22) $$E_{pneumatic,TOTAL,j} = E_{pneumatic,j} \times N_{well}$$

where:

$E_{pneumatic,TOTAL,j}$ is the total pneumatic device emissions of pollutant *j* in the county [ton/yr]
$E_{pneumatic,j}$ is the pneumatic device emissions of pollutant *j* for a type of well (gas vs. oil) [ton/yr/well]
N_{well} is the total number of active gas (or oil) wells in the county [wells]

Total emissions from pneumatic devices will be the combination of basin-wide emissions from each well type:

Equation 23) $$E_{allpneumatics,j} = \lfloor E_{pneumatic,TOTAL,j} \rfloor_{gaswells} + \lfloor E_{pneumatic,TOTAL,j} \rfloor_{oilwells}$$

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
PNEUMATIC_GAS_WELL_NO_BLEED_NUM_DEV	Count of "No Bleed" pneumatic devices at gas wells	COUNT	BASIN_FACTORS
PNEUMATIC_GAS_WELL_NO_BLEED_BLEED_RATE	Bleed rate of "No Bleed" pneumatic devices at gas wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_GAS_WELL_LOW_BLEED_NUM_DEV	Count of "Low Bleed" pneumatic devices at gas wells	COUNT	BASIN_FACTORS
PNEUMATIC_GAS_WELL_LOW_BLEED_BLEED_RATE	Bleed rate of "Low Bleed" pneumatic devices at gas wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_GAS_WELL_HIGH_BLEED_NUM_DEV	Count of "High Bleed" pneumatic devices at gas wells	COUNT	BASIN_FACTORS
PNEUMATIC_GAS_WELL_HIGH_BLEED_BLEED_RATE	Bleed rate of "High Bleed" pneumatic devices at gas wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_GAS_WELL_INTERM_BLEED_NUM_DEV	Count of "Intermittent" pneumatic devices at gas wells	COUNT	BASIN_FACTORS
PNEUMATIC_GAS_WELL_INTERM_BLEED_BLEED_RATE	Bleed rate of "Intermittent" pneumatic devices at gas wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_OIL_WELL_NO_BLEED_NUM_DEV	Count of "No Bleed" pneumatic devices at oil wells	COUNT	BASIN_FACTORS
PNEUMATIC_OIL_WELL_NO_BLEED_BLEED_RATE	Bleed rate of "No Bleed" pneumatic devices at oil wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_OIL_WELL_LOW_BLEED_NUM_DEV	Count of "Low Bleed" pneumatic devices at oil wells	COUNT	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
PNEUMATIC_OIL_WELL_LOW_BLEED_BLEED_RATE	Bleed rate of "Low Bleed" pneumatic devices at oil wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_OIL_WELL_HIGH_BLEED_NUM_DEV	Count of "High Bleed" pneumatic devices at oil wells	COUNT	BASIN_FACTORS
PNEUMATIC_OIL_WELL_HIGH_BLEED_BLEED_RATE	Bleed rate of "High Bleed" pneumatic devices at oil wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_GAS_WELL_INTERM_BLEED_NUM_DEV	Count of "Intermittent" pneumatic devices at oil wells	COUNT	BASIN_FACTORS
PNEUMATIC_OIL_WELL_INTERM_BLEED_BLEED_RATE	Bleed rate of "intermittent" pneumatic devices at oil wells	SCF/HR/ DEVICE	BASIN_FACTORS
PNEUMATIC_GASWELL_MW	Molecular weight of the vented gas emitted from pneumatic devices at gas wells	G/MOL	BASIN_FACTORS
PNEUMATIC_OILWELL_MW	Molecular weight of the vented gas emitted from pneumatic devices at oil wells	G/MOL	BASIN_FACTORS
PNEUMATIC_GASWELL_VOC	VOC Fraction of vented gas being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GASWELL_H2S	H2S Fraction of vented gas being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GASWELL_CO2	CO2 Fraction of vented gas being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GASWELL_CH4	CH4 Fraction of vented gas being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_OILWELL_VOC	VOC Fraction of vented gas being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OILWELL_H2S	H2S Fraction of vented gas being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OILWELL_CO2	CO2 Fraction of vented gas being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OILWELL_CH4	CH4 Fraction of vented gas being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_ANNUAL_OP_HR	Typical number of hours operated for pneumatic devices	Hours per year	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
PNEUMATIC_OIL_BENZ_VOC	Benzene fraction of VOC being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OIL_ETHYLBENZ_VOC	Ethylbenzene fraction of VOC being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OIL_TOLUENE_VOC	Toluene fraction of VOC being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OIL_XYLENE_VOC	Xylene fraction of VOC being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OIL_METHANE_VOC	Methane fraction of VOC being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_OIL_H2S	Hydrogen sulfide fraction of VOC being emitted from pneumatic devices at oil wells	Unitless	BASIN_FACTORS
PNEUMATIC_GAS_BENZ_VOC	Benzene fraction of VOC being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GAS_ETHYLBENZ_VOC	Ethylbenzene fraction of VOC being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GAS_TOLUENE_VOC	Toluene fraction of VOC being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GAS_XYLENE_VOC	Xylene fraction of VOC being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GAS_METHANE_VOC	Methane fraction of VOC being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS
PNEUMATIC_GAS_H2S	Hydrogen sulfide fraction of VOC being emitted from pneumatic devices at gas wells	Unitless	BASIN_FACTORS

6.2.8 Well Completions

Calculation sheet: WELL_COMPLETIONS_GAS_2310121700;
WELL_COMPLETIONS_OIL_2310111700

This category refers to emissions from well completions events, which includes initial completions and recompletions. Data provided in the HPDI database includes a count of annual

well completions (combines initial and recompletions), thus county-wide emissions will be a combination of the two. However, well completions characteristics will vary by well type; hence emissions were estimated separately for gas well completions and oil well completions. The calculation methodology for estimating emissions from a single completion event is shown below in Equation 24:

Equation 24) $$E_{completion,i} = \left(\frac{P \times \left(Q_{completion}\right)}{\left(R/_{MW_{gas}} \right) \times T \times 3.5 \times 10^{-5}} \right) \times \frac{f_i}{907185}$$

where:

- $E_{completion,i}$ is the uncontrolled emissions of pollutant *i* from a single completion event [ton/event]
- P is atmospheric pressure [1 atm]
- $Q_{completion}$ is the uncontrolled volume of gas generated per completion [MCF/event]
- R is the universal gas constant [0.082 L-atm/mol-K]
- MW_{gas} is the molecular weight of the gas [g/mol]
- T is the atmospheric temperature [298 K]
- f_i is the mass fraction of pollutant *i* in the completion venting gas
- $3.5x10^{-5}$ is the unit conversion factor MCF/L
- 907185 is the unit conversion factor g/ton

<u>Flaring emissions from well completion controls</u>

The methodology for estimating flaring emissions from completion venting processes is described below

Equation 25) $$E_{flare,completion} = \left(\frac{EF_i \times Q_{completion} \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right) \times HV}{1000} \times S_{county} \right) \Big/ 2000$$

where:

- $E_{flare,completion}$ is the county-wide flaring emissions of pollutant i for well completions [ton/yr]
- EF_i is the flaring emissions factor for pollutant *i* [lb/MMBtu]
- $Q_{completion}$ is the uncontrolled volume of gas generated per completion [MCF/event]
- HV is the local heating value of the gas [BTU/SCF]
- S_{county} is the county-wide number of well completion events for a particular year [events/yr]
- F is the fraction of well completions with flares
- $C_{capture}$ is the capture efficiency of the flare
- $C_{efficiency}$ is the control efficiency of the flare
- 2000 is the unit conversion factor lbs/ton
- 1000 is the unit conversion factor MCF/MMCF

The methodology for estimating SO_2 emissions from flaring of completion vent gas is shown below:

Equation 26)

$$E_{flare,completion,SO_2} = \left(\frac{P \times \left(Q_{completion} \times S_{county}\right) \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right)}{\left(R \big/ MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times f_{H_2S} \times 2 \big/ 907185$$

where:

$E_{flare,completion,SO_2}$ is the county-wide SO_2 flaring emissions from flaring of completion vent gas [ton/yr]
P is atmospheric pressure [1 atm]
$Q_{completion}$ is the uncontrolled volume of gas generated per completion [MCF/event]
S_{county} is the county-wide number of well completion events for a particular year [events/yr]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the completion venting gas [g/mol]
T is the atmospheric temperature [298 K]
f_{H_2S} is the mass fraction of H_2S in the completion venting gas
F is the fraction of well completions with flares
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
$3.5x10^{-5}$ is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

County-wide emissions are obtained by scaling-up well completions by well type with the number of completions events (also by well type) for a particular year. This can be done applying Equation 27:

Equation 27)

$$E_{completion,TOTAL} = E_{completion,i} \times S_{county}\left(1 - F_{flare} \times \left(C_{captured}\right) \times \left(C_{efficiency}\right) - F_{green}\right) + E_{flare,completion,i}$$

where:

$E_{completion,TOTAL}$ are the total emissions county-wide of pollutant i from well completions [tons/year]
$E_{completion,i}$ are the completion emissions from a single completion event [tons/event]
F_{green} is the fraction of completions in the basin that were controlled by green completion techniques
F_{flare} is the fraction of completions in the basin controlled by flare

$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
S_{county} is the county-wide total completions events in a particular year [events/year]
$E_{flare,completion,i}$ is the county-wide flaring emissions from flaring of completion vent gas [ton/yr]

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
WELL_COMP_VOL_GAS_VENTED	Volume of gas generated per completion	MCF/EVENT	BASIN_FACTORS
WELL_COMP_FRACT_WITH_FLARING	Fraction of well completions with flares	Unitless	BASIN_FACTORS
WELL_COMP_FLARING_CONT_EFF	Control Efficiency of the flare	Unitless	BASIN_FACTORS
WELL_COMP_FLARING_CAPTURE_EFF	Capture Efficiency of the flare	Unitless	BASIN_FACTORS
WELL_COMP_CONT_GREEN	Fraction of well completions controlled by green completion techniques	Unitless	BASIN_FACTORS
WELL_COMP_OIL_VOC_WT_PCT	Fraction of VOC in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_H2S_WT_PCT	Fraction of Hydrogen sulfide in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_CO2_WT_PCT	Fraction of Carbon dioxide in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_CH4_WT_PCT	Fraction of Methane in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_BENZ_WT_PCT	Fraction of Benzene in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_ETHYLBENZ_WT_PCT	Fraction of Ethylbenzene in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_TOLUENE_WT_PCT	Fraction of Toluene in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_XYLENE_WT_PCT	Fraction of Xylene in the vented gas during completion at oil wells	Unitless	BASIN_FACTORS
WELL_COMP_OIL_LHV	Heating value of the vented gas during completion at oil wells	BTU/SCF	BASIN_FACTORS
WELL_COMP_OIL_MW	Molecular weight of the vented gas during completion at oil wells	G/MOL	BASIN_FACTORS
WELL_COMP_GAS_VOC_WT_PCT	Fraction of VOC in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS
WELL_COMP_GAS_H2S_WT_PCT	Fraction of Hydrogen sulfide in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS
WELL_COMP_GAS_CO2_WT_PCT	Fraction of Carbon dioxide in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS
WELL_COMP_GAS_CH4_WT_PCT	Fraction of Methane in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
WELL_COMP_GAS_BENZ_WT_PCT	Fraction of Benzene in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS
WELL_COMP_GAS_ETHYLBENZ_WT_PCT	Fraction of Ethylbenzene in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS
WELL_COMP_GAS_TOLUENE_WT_PCT	Fraction of Toluene in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS
WELL_COMP_GAS_XYLENE_WT_PCT	Fraction of Xylene in the vented gas during completion at gas wells	Unitless	BASIN_FACTORS
WELL_COMP_GAS_LHV	Heating value of the vented gas during completion at gas wells	BTU/SCF	BASIN_FACTORS
WELL_COMP_GAS_MW	Molecular weight of the vented gas during completion at gas wells	G/MOL	BASIN_FACTORS

6.2.9 Blowdowns

Calculation sheet: BLOWDOWNS_2310021603

This source category refers to the practice of venting gas from gas wells to prevent liquid build-up in the well that could limit production. This practice is also commonly referred as "liquids unloading". Vented gas from blowdowns is a VOC emissions source. Emissions from blowdowns are based on the average venting volume per blowdown and the gas composition of the vented gas. Blowdown emissions may be controlled by a combustion device such as a flare, or may also be controlled by "smart" plunger lift devices, which decrease liquids build-up and thus reduce the amount of venting volume from the blowdowns. The calculation methodology for estimating emissions from a single blowdown event is shown below in Equation 28:

Equation 28)
$$E_{blowdown,i} = \left(\frac{P \times (V_{vented})}{\left(R/MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times \frac{f_i}{907185}$$

where:

- $E_{blowdown,i}$ is the emissions of pollutant *i* from a single blowdown event [ton/event]
- P is atmospheric pressure [1 atm]
- V_{vented} is the volume of vented gas per blowdown [MCF/event]
- R is the universal gas constant [0.082 L-atm/mol-K]
- MW_{gas} is the molecular weight of the gas [g/mol]
- T is the atmospheric temperature [298 K]
- f_i is the mass fraction of pollutant *i* in the vented gas
- 3.5×10^{-5} is the unit conversion factor MCF/L

907185 is the unit conversion factor g/ton

Emissions from flare controls for blowdown vents

In case a region applies flaring controls to blowdown vents, the methodology for estimating flaring emissions is described below:

Equation 29)

$$E_{flare,blowdown} = \left(\frac{EF_i \times V_{vented} \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right) \times HV}{1000} \times S_{county} \times N_{blowdown} \right) \Big/ 2000$$

where:

$E_{flare,blowdown}$ is the county-wide flaring emissions of pollutant i for blowdowns [ton/yr]
EF_i is the flaring emissions factor for pollutant *i* [lb/MMBtu]
V_{vented} is the volume of vented gas per blowdown [MCF/event]
HV is the local heating value of the gas [BTU/SCF]
S_{county} is the county-wide number of active gas wells for a particular year [wells]
$N_{blowdown}$ the average number of annual blowdowns per well in the basin [event/yr-well]
F is the fraction of well blowdowns that are flared
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
1000 is the unit conversion factor MCF/MMCF
2000 is the unit conversion factor lb/ton

The methodology for estimating SO_2 emissions from flaring of blowdown gas is shown below

Equation 30)

$$E_{flare,blowdown,SO_2} = \left(\frac{P \times \left(V_{vented} \times S_{county} \times N_{blowdown}\right) \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right)}{\left(R \big/ MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times f_{H_2S} \times 2 \big/ 907185$$

where:

$E_{flare,blowdown,SO_2}$ is the county-wide SO_2 flaring emissions from flaring of blowdown vent gas [ton/yr]
P is atmospheric pressure [1 atm]
V_{vented} is the volume of vented gas per blowdown [MCF/event]
S_{county} is the county-wide number of gas wells [wells]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the blowdown gas [g/mol]
T is the atmospheric temperature [298 K]
f_{H_2S} is the mass fraction of H_2S in the blowdown venting gas

F is the fraction of blowdowns with flares
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
$N_{blowdown}$ the average number of annual blowdowns per well in the basin [event/yr-well]
$3.5x10^{-5}$ is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

The total county-level emissions from all blowdowns are evaluated following Equation 31:

Equation 31) $$E_{blowdown,TOTAL} = E_{blowdown,i} \times N_{blowdown} \times N_{wells} \times \left(1 - F_{control,device} \times C_{efficiency}\right)$$

where:

$E_{blowdown,TOTAL}$ are the total county-wide emissions of pollutant i from blowdowns [tons/yr]
$E_{blowdown,i}$ are the blowdown emissions from a single blowdown event [tons/event]
$F_{control,device}$ is the fraction of blowdowns in the basin that were controlled
$C_{efficiency}$ is the control efficiency of the control technology used (plunger lifts for example)
$N_{blowdown}$ is the average number of annual blowdowns per well in the basin [event/yr-well]
N_{wells} is the total number of active **gas** wells in the county for a particular year [well]

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
BLOWDOWN_AVG_FREQ	Average number of annual blowdowns per well	EVENT/YEAR	BASIN_FACTORS
BLOWDOWN_VOL_GAS_VENTED	Volume of gas generated per blowdown	MCF/EVENT	BASIN_FACTORS
BLOWDOWN_FREQ_CONT_METHOD	Control Technology frequently used	Type	BASIN_FACTORS
BLOWDOWN_FRACT_CONTROLLED	Fraction of blowdowns with control method	Unitless	BASIN_FACTORS
BLOWDOWN_CONTROL_METHD_EFF	Control Efficiency of the method	Unitless	BASIN_FACTORS
BLOWDOWN_VOC_WT_PCT	Fraction of VOC in the vented gas during blowdowns	Unitless	BASIN_FACTORS
BLOWDOWN_H2S_WT_PCT	Fraction of Hydrogen sulfide in the vented gas during blowdowns	Unitless	BASIN_FACTORS
BLOWDOWN_CO2_WT_PCT	Fraction of Carbon dioxide in the vented gas during blowdowns	Unitless	BASIN_FACTORS
BLOWDOWN_CH4_WT_PCT	Fraction of Methane in the vented gas during blowdowns	Unitless	BASIN_FACTORS
BLOWDOWN_BENZ_WT_PCT	Fraction of Benzene in the vented gas during blowdowns	Unitless	BASIN_FACTORS
BLOWDOWN_ETHYLBENZ_WT_PCT	Fraction of Ethylbenzene in the vented gas during blowdowns	Unitless	BASIN_FACTORS
BLOWDOWN_TOLUENE_WT_PCT	Fraction of Toluene in the vented gas	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
	during blowdowns		
BLOWDOWN_XYLENE_WT_PCT	Fraction of Xylene in the vented gas during blowdowns	Unitless	BASIN_FACTORS
BLOWDOWN_VENT_MW	Molecular weight of the vented gas during blowdowns	G/MOL	BASIN_FACTORS

6.2.10 Hydraulic Fracturing Pumps

Calculation Sheet: HYDRAULIC_FRACTURING_2310000660

This category refers to equipment used in hydraulic fracturing practices during well completions and recompletions, generally related to unconventional oil and gas production such as shale gas and tight sands oil/gas. Engines used during hydraulic fracturing are generally large diesel-fueled pumps that can be a significant NOx emissions source. Average emissions factors for hydraulic fracturing engines were derived from EPA's NONROAD2008 model based on the oil equipment source category bin in NONROAD. The basic methodology for estimating exhaust emissions from engines used at a hydraulic fracturing event is shown below

Equation 32) $$E_{fracing,event,i} = n \times \frac{EF_i \times HP \times LF \times N_{stages} \times t_{stage}}{907{,}185}$$

where:

$E_{fracing,event}$ is the exhaust emissions for pollutant i from a single fracing event [ton/event]
EF_i is the emissions factor of pollutant *i* [g/hp-hr]
HP is the horsepower of the engine [hp]
LF is the load factor of the engine
N_{stages} is the number of stages per fracing event [stage/event]
t_{annual} is the duration of the fracturing stage [hr/stage]
n is the number of engines used per fracing event
907185 is the unit conversion factor g/ton

<u>Extrapolation to county-level emissions</u>

Frac pump emissions can be scaled up to the county level on the basis of horizontal spuds. It is assumed that hydraulic fracturing is performed in all horizontal spuds and thus the methodology for scaling up fracturing pump engine emissions is based on this surrogate as shown below:

Equation 33) $$E_{frac,pumps,TOTAL,i} = N_{event} \times E_{fracing,event,i}$$

where:

$E_{frac,pump,TOTAL}$ is the total emissions from frac pump engines in the county [ton/yr]
$E_{fracing,event}$ is the total exhaust emissions from engines in a single fracing event [ton/event]
N_{events} is the number of horizontal wells drilled in a particular year [spuds/yr]

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
HYDRAULIC_FRACTURE_HP	Typical horsepower (HP) of a hydraulic fracture engine	HP	BASIN_FACTORS
HYDRAULIC_FRACTURE_LOAD_FACTOR	Typical load factor of a hydraulic fracture engine	Unitless	BASIN_FACTORS
HYDRAULIC_FRACTURE_STAGES_WELL	Number of stages per fracturing event	COUNT	BASIN_FACTORS
HYDRAULIC_FRACTURE_HR_STAGE	Typical duration of the fracturing stage	Hours per stage	BASIN_FACTORS
HYDRAULIC_FRACTURE_TOTAL_DURATION	Total number of hours for fracturing	Hours per year	BASIN_FACTORS
HYDRAULIC_FRACTURE_ENGINES_EVENT	Number of fracturing engines used per fracturing event	COUNT	BASIN_FACTORS
HYDRAULIC_FRACTURE_HP-HR_WELL	Total horsepower-hour from hydraulic fracturing per well	HP-HR/WELL	BASIN_FACTORS
HYDRAULIC_FRACTURE_ALT_EF	Alternative value, if available, for hydraulic fracturing	G/HP-HR	BASIN_FACTORS

6.2.11 Fugitive Leaks

Calculation Sheets: FUGITIVE_GAS_CON_2310021501; FUGITIVE_GAS_FLANGES_2310021502; FUGITIVE_GAS_OEL_2310021503; FUGITIVE_GAS_VALVES_2310021505; FUGITIVE_GAS_COMSEAL_2310021506; FUGITIVE_OIL_CON_2310021501; FUGITIVE_OIL_FLANGES_2310021502; FUGITIVE_OIL_OEL_2310021503; FUGITIVE_OIL_VALVES_2310021505;

This source category refers to leaking emissions of produced gas that escape through well site and pipeline components such as connectors, flanges, open-ended lines and valves. As a revision to the CENRAP study (Bar-Ilan, et al., 2008), compressor wet seals fugitive emissions have been added to this inventory. It must be noted that this source category refers only to fugitive emissions components located at the wellhead and that large transmission pipeline fugitives and other midstream fugitives sources are not part of this analysis.

Fugitive emissions for an individual typical well are estimated according to Equation 34:

Equation 34)

$$E_{fugitive,j} = \sum_i EF_i \times N_i \times t_{annual} \times Y_j$$

where:

$E_{fugitive,j}$ is the fugitive emissions for a single typical well for pollutant j [ton/yr/well]
EF_i is the emission factor of TOC for a single component i [kg/hr/component]

N_i is the total number of components of type *i*
t_{annual} is the annual number of hours the well is in operation [8760 hr/yr]
Y_j is the mass ratio of pollutant *j* to TOC in the vented gas

In addition, fugitive leaks from wellhead compressor seals can be estimated from the following equation

Equation 35) $$E_{compressor,fug,CH4} = \left(\frac{P \times (V_{vented}) \times t}{\left(R/MW_{gas} \right) \times T \times 3.5 \times 10^{-5} \times 24} \right) \times \frac{(f_{wellhead} + 1/N_{lateral})}{907185 * 1000} \times W_{gas}$$

where:

$E_{compressor,fug,CH4}$ is the county-wide methane fugitive emissions from compressor seals [ton/yr]
P is atmospheric pressure [1 atm]
V_{vented} is the volume of leaked gas per compressor [SCF/compressor/day]
t is the annual hours of operation for wellhead compressors [hrs/yr]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the pollutant [g/mol]
T is the atmospheric temperature [298 K]
$f_{wellhead}$ is the fraction of wells with wellhead compressors
$N_{lateral}$ is the number of gas wells served by a lateral compressor engine
W_{gas} is the county-wide number of gas wells
3.5×10^{-5} is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton
1000 is the unit conversion factor SCF/MCF
24 is the unit conversion factor hr/day

To estimate emissions from other pollutants (VOC, CO2, H2S) the following equation may be used:

Equation 36) $$E_{compressor,fug,i} = E_{compressorfug,CH4} \times \frac{MW_i}{MW_{CH4}} \times \frac{M_i}{M_{CH4}}$$

where:

$E_{compressor,fug,i}$ is the county-wide compressor fugitive emissions for pollutant i [ton/yr]
$EF_{compressor,fug,CH4}$ is the compressor fugitive emissions for methane [ton CH4/yr]
MW_i is the molecular weight of pollutant i [lb/lb-mol]
MW_{CH4} is the molecular weight of methane [lb/lb-mol]
M_{CH4} is the mole percent of methane in the local gas [%]
M_i is the mole percent of pollutant in the local gas [%]

Extrapolation to county-level emissions

County-wide fugitive emissions from well-site piping components are estimated according to Equation 37

Equation 37) $$E_{fugitive,TOTAL} = E_{fugitive,j} \times N_{well}$$

where:

$E_{fugitive,TOTAL}$ is the total fugitive emissions from well-site piping components in the county [ton/yr]
$E_{fugitive,j}$ is the fugitive emissions for a single well of pollutant j [ton/yr/well] (from Equation 35)
N_{well} is the total number of active wells in the county [wells]

Total county-wide fugitive emissions are the sum of compressor seals emissions and by-component fugitive emissions.

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
FUG_VALVES_GAS	Count of valves per gas service	COUNT	BASIN_FACTORS
FUG_VALVES_HO	Count of valves per heavy oil service	COUNT	BASIN_FACTORS
FUG_VALVES_LO	Count of valves per light oil service	COUNT	BASIN_FACTORS
FUG_VALVES_WO	Count of valves per water/oil service	COUNT	BASIN_FACTORS
FUG_PUMP_SEALS_GAS	Count of pump seals per gas service	COUNT	BASIN_FACTORS
FUG_PUMP_SEALS_HO	Count of pump seals per heavy oil service	COUNT	BASIN_FACTORS
FUG_PUMP_SEALS_LO	Count of pump seals per light oil service	COUNT	BASIN_FACTORS
FUG_PUMP_SEALS_WO	Count of pump seals per water/oil service	COUNT	BASIN_FACTORS
FUG_OTHERS_GAS	Count of compressor seals per gas service	COUNT	BASIN_FACTORS
FUG_OTHERS_HO	Count of compressor seals per heavy oil service	COUNT	BASIN_FACTORS
FUG_OTHERS_LO	Count of compressor seals per light oil service	COUNT	BASIN_FACTORS
FUG_OTHERS_WO	Count of compressor seals per water/oil service	COUNT	BASIN_FACTORS
FUG_CONN_GAS	Count of connectors per gas service	COUNT	BASIN_FACTORS
FUG_CONN_HO	Count of connectors per heavy oil service	COUNT	BASIN_FACTORS
FUG_CONN_LO	Count of connectors per light oil service	COUNT	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
FUG_CONN_WO	Count of connectors per water/oil service	COUNT	BASIN_FACTORS
FUG_FLANGES_GAS	Count of flanges per gas service	COUNT	BASIN_FACTORS
FUG_FLANGES_HO	Count of flanges per heavy oil service	COUNT	BASIN_FACTORS
FUG_FLANGES_LO	Count of flanges per light oil service	COUNT	BASIN_FACTORS
FUG_FLANGES_WO	Count of flanges per water/oil service	COUNT	BASIN_FACTORS
FUG_OEL_GAS	Count of open-ended lines per gas service	COUNT	BASIN_FACTORS
FUG_OEL_HO	Count of open-ended lines per heavy oil service	COUNT	BASIN_FACTORS
FUG_OEL_LO	Count of open-ended lines per light oil service	COUNT	BASIN_FACTORS
FUG_OEL_WO	Count of open-ended lines per water/oil service	COUNT	BASIN_FACTORS
FUG_ANNUAL_HRS	Annual operating hours for fugitive components	Hours per year	BASIN_FACTORS
FUG_GW_VOC_TOC	Fraction of VOC in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_GW_H2S_TOC	Fraction of Hydrogen sulfide in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_GW_CO2_TOC	Fraction of Carbon dioxide in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_GW_CH4_TOC	Fraction of Methane dioxide in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_GW_BENZ_TOC	Fraction of Benzene dioxide in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_GW_ETHYLBENZ_TOC	Fraction of Ethylbenzene dioxide in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_GW_TOLUENE_TOC	Fraction of Toluene dioxide in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_GW_XYLENE_TOC	Fraction of Xylene dioxide in Total organic compounds at gas wells	Unitless	BASIN_FACTORS
FUG_OW_VOC_TOC	Fraction of VOC in Total organic compounds at oil wells	Unitless	BASIN_FACTORS
FUG_OW_H2S_TOC	Fraction of Hydrogen sulfide in Total organic compounds at oil wells	Unitless	BASIN_FACTORS
FUG_OW_CO2_TOC	Fraction of Carbon dioxide in Total organic compounds at oil wells	Unitless	BASIN_FACTORS
FUG_OW_CH4_TOC	Fraction of Methane in Total organic compounds at oil wells	Unitless	BASIN_FACTORS
FUG_OW_BENZ_TOC	Fraction of Benzene in Total organic compounds at oil wells	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
FUG_OW_ETHYLBENZ_TOC	Fraction of Ethylbenzene in Total organic compounds at oil wells	Unitless	BASIN_FACTORS
FUG_OW_TOLUENE_TOC	Fraction of Toluene in Total organic compounds at oil wells	Unitless	BASIN_FACTORS
FUG_OW_XYLENE_TOC	Fraction of Xylene in Total organic compounds at oil wells	Unitless	BASIN_FACTORS
FUG_COMP_SEAL_CH4_LEAKING	Methane leaking rate per compressor daily	SCF/HR/ COMPRESSOR	BASIN_FACTORS
FRACT_WELL_COMPRESS	Fraction of wells serviced by wellhead compressors	Unitless	BASIN_FACTORS
NUM_WELL_COMPRESS	Number of wells serviced by a single lateral compressor	COUNT	BASIN_FACTORS
FUG_COMP_SEAL_HOURS_OP	Annual operating hours for compressors	Hours per year	BASIN_FACTORS
FUG_GAS_LHV	Heating value of the leaked gas at compressor seals	BTU/SCF	BASIN_FACTORS
FUG_GAS_MW	Molecular weight of the leaked gas at compressor seals	G/MOL	BASIN_FACTORS
FUG_GAS_VOC_WT_FRACT	VOC fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
FUG_GAS_H2S_WT_FRACT	Hydrogen sulfide fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
FUG_GAS_CO2_WT_FRACT	Carbon dioxide fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
FUG_GAS_CH4_WT_FRACT	Methane fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
FUG_GAS_BENZ_WT_FRACT	Benzene fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
FUG_GAS_ETHYLBENZ_WT_FRACT	Ethylbenzene fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
FUG_GAS_TOLUENE_WT_FRACT	Toluene fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
FUG_GAS_XYLENE_WT_FRACT	Xylene fraction in leaked gas at compressor seals	Unitless	BASIN_FACTORS
VOC_MOL_PCT	VOC molar PCT Value	Unitless	BASIN_FACTORS
CO2_MOL_PCT	Carbon dioxide molar PCT Value	Unitless	BASIN_FACTORS
CH4_MOL_PCT	Methane molar PCT Value	Unitless	BASIN_FACTORS
H2S_MOL_PCT	Hydrogen sulfide molar PCT Value	Unitless	BASIN_FACTORS
VOC_MOL_WT	Molecular weight of VOC	G/MOL	BASIN_FACTORS

6.2.12 Heaters

Calculation sheets: HEATERS_OIL_2310010100; HEATERS_GAS_2310021100

This category refers to natural gas-fired external combustors used in oil and gas production facilities to provide heat input to separator (separator heaters) or to provide heat to tanks (tank heaters). It must be noted that this category does not refer to reboilers used in dehydrators as those emissions are captured in the dehydrator source category. The basic methodology for estimating emissions for all pollutants except SO_2 for a single heater is shown in Equation 38. Local fuel gas properties will vary between gas wells and oil wells; hence emissions were estimated separately for this category. Due to limited field data for this category, all other parameters unrelated to local gas composition were assumed to be the same for gas and oil wells.

Equation 38)
$$E_{heater} = \frac{EF_{heater} \times Q_{heater} \times t_{annual} \times hc}{\left(HV_{local} \times 2000\right)}$$

where:

E_{heater} is the emissions from a given heater [ton/yr]
EF_{heater} is the emission factor for a heater for a given pollutant [lb/million SCF]
Q_{heater} is the heater MMBTU/hr rating [$MMBTU_{rated}$/hr]
HV_{local} is the local natural gas heating value [BTU_{local}/SCF]
t_{annual} is the annual hours of operation [hr/yr]
hc is a heater cycling fraction to account for the fraction of operating hours that the heater is firing (if not available, hc=1)
2000 is the unit conversion factor lb/ton

The methodology for estimating SO_2 emissions from heaters requires first estimating the mass of gas combusted in the heater, and then uses the mass fraction of H_2S in the gas and the assumption that all H_2S is converted to SO_2. This methodology is described in Equation 39

Equation 39)
$$E_{heater,SO_2} = \frac{2 \times f_{H_2S}}{907185} \times \left(\frac{Q_{heater} \times t_{annual} \times hc}{\left(HV_{local}\right)} \times \frac{P}{\left(\left(R/MW_{gas}\right) \times T \times 0.035\right)} \right)$$

where:

E_{heater,SO_2} is the SO_2 emissions from a given heater [ton-SO_2/yr]
f_{SO_2} is the mass fraction of H_2S in the gas
Q_{heater} is the heater MMBTU/hr rating [$MMBTU_{rated}$/hr]
HV_{local} is the local natural gas heating value [$MMBTU_{local}$/scf]
t_{annual} is the annual hours of operation [hr/yr]

hc is a heater cycling fraction to account for the fraction of operating hours that the heater is firing
P is atmospheric pressure [1 atm]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
3.5×10^{-3} is the unit conversion factor SCF/L
907185 is the unit conversion factor g/ton
1000 is the unit conversion factor SCF/MCF

Extrapolation to county-level emissions

County-wide heater emissions are estimated by determining the typical number of heaters per well and scaling up by well count. This is shown in Equation 40:

Equation 40) $$E_{heater,TOTAL} = E_{heater} \times N_{heater} \times W_{TOTAL}$$

where:

$E_{heater,TOTAL}$ is the total heater emissions in a county for a specific pollutant [ton/yr]
E_{heater} is the total emissions from a single heater for a specific pollutant [ton/yr]
W_{TOTAL} is the total number of wells in the county
N_{heater} is the typical number of heaters per well throughout in the basin

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
NUM_HEATERS_TYPICAL	Typical number of heaters at a well	COUNT	BASIN_FACTORS
HEATER_RATING	Heater rating	MMBTU/HR	BASIN_FACTORS
HEATER_ANNUAL_OP_HOURS	Typical number of hours operated for heaters	Hours per year	BASIN_FACTORS
HEATER_CYCLING	Fraction to account for the fraction of operating hours that the heater is firing	Unitless	BASIN_FACTORS
HEATER_GASWELL_H2S_FRAC	Fraction of hydrogen sulfide in the natural gas	Unitless	BASIN_FACTORS
HEATER_GASWELL_LOCAL_HV	Heating value of the natural gas used for fuel	BTU/SCF	BASIN_FACTORS
HEATER_GASWELL_MW	Molecular weight of the gas emitted from the gas well heater	G/MOL	BASIN_FACTORS
HEATER_OILWELL_H2S_FRAC	Fraction of hydrogen sulfide in the oil	Unitless	BASIN_FACTORS
HEATER_OILWELL_LOCAL_HV	Heating value of the oil used for fuel	BTU/SCF	BASIN_FACTORS
HEATER_OILWELL_MW	Molecular weight of the gas emitted from the oil well heater	G/MOL	BASIN_FACTORS

6.2.13 Loading Emissions

Calculation Sheets: LOADING_COND_2310021030; LOADING_CRUDE_2310011201

This category refers to loading losses that occur when transferring hydrocarbon liquids, crude oil or condensate, from storage tanks to cargo trucks. The emissions will vary by the gas speciation of the working losses; hence emissions were calculated separately for each hydrocarbon liquid. Equations 41-44 may be used for both categories (SCCs). The loading loss rate is estimated following Equation 41:

Equation 41) $$L = 12.46 \times \left(\frac{S \times V \times M}{T \times 1000} \right)$$

where:

L is the loading loss rate [lb/1000gal]
S is the saturation factor taken from AP-42 default values based on operating mode (here assumed as submerged loading: dedicated normal service)
V is the true vapor pressure of the liquid loaded [psia]
M is the molecular weight of the vapor [lb/lb-mole]
T is the temperature of the bulk liquid [^{o}R]

VOC truck loading emissions are then estimated by Equation 42 which is dependent on the VOC fraction in the gas. When available, basin-specific working/breathing gas compositions from condensate/crude oil storage tanks were used in Equations 42-44; however when basin-level data was limited or unavailable, produced gas analyses were used to speciate emissions from each pollutant.

Equation 42) $$E_{loading,\ VOC} = \frac{L}{1000} \times Y_{voc} \times \frac{42}{2000}$$

where:

$E_{loading}$ are the VOC tank loading emissions [ton-VOC/bbl]
L is the loading loss rate [lb/1000gal]
Y_{VOC} is the weight fraction of VOC in the vapor in the liquid loaded
42 is a unit conversion [gal/bbl]
2000 is a unit conversion [lbs/ton]

CO_2 and CH_4 emissions are calculated based on Equations 43-44:

Equation 43) $$E_{loading,CH4} = E_{loading,VOC} \times \frac{weight\ fraction_{CH4}}{weight\ fraction_{VOC}}$$

Equation 44) $$E_{loading,CO2} = E_{loading,VOC} \times \frac{weight\ fraction_{CO2}}{weight\ fraction_{VOC}}$$

where:

$E_{loading,CO2}$ is the total loading CO_2 emissions per barrel of liquid [ton/bbl]

$E_{loadingCH4}$ is the total loading CH_4 emissions per barrel of liquid [ton/bbl]

Weight fractions of each pollutant in the vapor losses from the liquid loaded

Extrapolation to county-level emissions

Annual emissions per pollutant i from condensate loading were scaled to county-level by annual condensate production per Equation 45:

Equation 45) $$E_{tank\ loadout,\ i} = E_{loading,\ i} \times S_{bbl\ condensate} \times F_{trucked}$$

where:

$E_{tank\ loadout,\ i}$ is the annual county-level emissions for pollutant i from condensate tank load-out [ton/yr]
$E_{loading,\ i}$ is the emissions for pollutant i from loading per barrel [ton/bbl]
$S_{bbl\ condensate}$ is the total annual of barrels condensate produced county-wide [bbl/yr]
$F_{pipeline}$ is the fraction of condensate production that is delivered by truck

Annual emissions per pollutant i from oil loading were scaled to county-level by annual oil production per Equation 46:

Equation 46) $$E_{tank\ loadout,oil,\ i} = E_{loading,\ i} \times S_{bbl\ oil} \times F_{trucked}$$

where:

$E_{tank\ loadout,\ i}$ is the annual county-level emissions for pollutant i from crude oil tank load-out [ton/yr]
$E_{loading,\ i}$ is the emissions for pollutant i from loading per barrel [ton/bbl]
$S_{bbl\ oil}$ is the total annual oil produced county-wide [bbl/yr]
$F_{pipeline}$ is the fraction of oil production that is delivered by truck

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
LOADING_OP_MODE	Typical operating mode for liquids loading	TYPE	BASIN_FACTORS
LOADING_SAT_FAC	Saturation factor based on operating mode	Unitless	BASIN_FACTORS
LOADING_FRAC_COND_TRUCK	Fraction of condensate loading to trucks	Unitless	BASIN_FACTORS
LOADING_FRAC_CRUDE_TRUCK	Fraction of crude oil loading to trucks	Unitless	BASIN_FACTORS
LOADING_COND_BULK_LIQ_T	Temperature of the bulk condensate	R	BASIN_FACTORS
LOADING_COND_VOC_WT_PCT	Fraction of VOC in the vapor of loaded condensate	Unitless	BASIN_FACTORS
LOADING_COND_CO2_WT_PCT	Fraction of Carbon dioxide in the vapor of loaded condensate	Unitless	BASIN_FACTORS
LOADING_COND_CH4_WT_PCT	Fraction of Methane in the vapor of loaded condensate	Unitless	BASIN_FACTORS
LOADING_COND_MW_VAPOR	Molecular weight of condensate vapor	G/MOL	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
LOADING_COND_PRESS_VAPOR	True vapor pressure of the condensate	PSIA	BASIN_FACTORS
LOADING_OIL_BULK_LIQ_T	Temperature of the bulk crude oil	R	BASIN_FACTORS
LOADING_OIL_VOC_WT_PCT	Fraction of VOC in the vapor of loaded crude oil	Unitless	BASIN_FACTORS
LOADING_OIL_CO2_WT_PCT	Fraction of Carbon dioxide in the vapor of loaded crude oil	Unitless	BASIN_FACTORS
LOADING_OIL_CH4_WT_PCT	Fraction of Methane in the vapor of loaded crude oil	Unitless	BASIN_FACTORS
LOADING_OIL_MW_VAPOR	Molecular weight of crude oil vapor	G/MOL	BASIN_FACTORS
LOADING_OIL_PRESS_VAPOR	True vapor pressure of the crude oil	PSIA	BASIN_FACTORS
LOADING_COND_BENZ_VOC	Benzene ratio to VOC being emitted during condensate loading	Unitless	BASIN_FACTORS
LOADING_COND_ETHYLBENZ_VOC	Ethylbenzene ratio to VOC being emitted during condensate loading	Unitless	BASIN_FACTORS
LOADING_COND_TOLUENE_VOC	Toluene ratio to VOC being emitted during condensate loading	Unitless	BASIN_FACTORS
LOADING_COND_XYLENE_VOC	Xylene ratio to VOC being emitted during condensate loading	Unitless	BASIN_FACTORS
LOADING_COND_METHANE_VOC	Methane ratio to VOC being emitted during condensate loading	Unitless	BASIN_FACTORS
LOADING_COND_H2S_VOC	Hydrogen sulfide ratio to VOC being emitted during condensate loading	Unitless	BASIN_FACTORS
LOADING_CRUDE_BENZ_VOC	Benzene ratio to VOC being emitted during crude oil loading	Unitless	BASIN_FACTORS
LOADING_CRUDE_ETHYLBENZ_VOC	Ethylbenzene ratio to VOC being emitted during crude oil loading	Unitless	BASIN_FACTORS
LOADING_CRUDE_TOLUENE_VOC	Toluene ratio to VOC being emitted during crude oil loading	Unitless	BASIN_FACTORS
LOADING_CRUDE_XYLENE_VOC	Xylene ratio to VOC being emitted during crude oil loading	Unitless	BASIN_FACTORS
LOADING_CRUDE_METHANE_VOC	Methane ratio to VOC being emitted during crude oil loading	Unitless	BASIN_FACTORS
LOADING_CRUDE_H2S_VOC	Hydrogen sulfide ratio to VOC being emitted during crude oil loading	Unitless	BASIN_FACTORS

6.2.14 Gas-Actuated Pumps

Calculation sheets: GAS_ACT_GAS_2310121401; GAS_ACT_OIL_2310111401.

Gas-actuated pumps refer to small gas-driven plunger pumps used at oil and gas production sites, to provide a constant supply of chemicals or lubricants to specific flow lines or equipment. These are regularly used in sites where electric power is unavailable. As part of their operation, gas-driven pumps vent part of the driving gas to the atmosphere, making them a VOC and

methane emissions source. Two types of gas-actuated pumps were considered: Kimray pumps and chemical injection pumps (CIP). For oil wells only CIPs are assumed to be used. Annual vented gas rates per well from Kimray pumps are estimated following Equation 47:

Equation 47) $$E_{kimray,CH4} = \frac{EF_{CH4}}{907185} \times Q_{kimray} \times \frac{P}{1000 \times \left(\left(R / MW_{gas} \right) \times T \times 3.5 \times 10^{-5} \right)}$$

where:

$E_{kimray,CH4}$ is the per-well methane emissions from Kimray pumps at gas wells [tons-CH4/well-yr]
EF_{CH4} is the methane emissions factor for a Kimray pump per unit throughput [SCF-CH4/MMSCF]
Q_{kimray} is the average gas pumped per well annually with Kimray pumps [MMSCF/well-yr]
P is the atmospheric pressure [1 atm]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
T is the atmospheric temperature [298 K]
3.5×10^{-5} is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton
1000 is the unit conversion factor SCF/MCF

Emissions from CIPs are estimated based on equation 48:

Equation 48) $$E_{CIP,CH4} = \frac{EF_{CH4}}{907185} \times N_{CIP} \times \frac{t_{CIP}}{24} \times \frac{P}{1000 \times \left(\left(R / MW_{methane} \right) \times T \times 3.5 \times 10^{-5} \right)}$$

where:

$E_{CIP,CH4}$ is the per-well methane emissions from CIP pumps at gas wells [tons-CH4/well-yr]
EF_{CH4} is the methane emissions factor for a CIP pump [SCF-CH4/pump/day]
N_{CIP} is the average number of CIPs per well [pump/well]
t_{CIP} is the regular operation time for chemical injection pumps [hrs/yr]
P is the atmospheric pressure [1 atm]
R is the universal gas constant [0.082 L-atm/mol-K]
$MW_{methane}$ is the molecular weight of methane [g/mol]
T is the atmospheric temperature [298 K]
3.5×10^{-5} is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton
1000 is the unit conversion factor SCF/MCF

To estimate emissions from other pollutants (VOC, CO2, H2S, HAPs) from Kimray and CIP pumps, the following equation may be used:

Equation 49) $$E_{pump,i} = E_{pump_{CH4}} \times \frac{MW_i}{MW_{CH4}} \times \frac{M_i}{M_{CH4}}$$

where:

$E_{pump,i}$ is the emissions for pollutant i per well from CIPs or Kimray Pumps [ton/well-yr]
$EF_{pump,CH4}$ is the methane emissions from CIPs or Kimray Pumps [ton CH4/well-yr] (from equations 47 or 48)
MW_i is the molecular weight of pollutant i [lb/lb-mol]
MW_{CH4} is the molecular weight of methane [lb/lb-mol]
M_{CH4} is the mole percent of methane in the local gas vented from the pump [%]
M_i is the mole percent of pollutant in the local gas vented from the pump [%]

Extrapolation to county-level emissions

To estimate county-wide annual emissions from gas-actuated pumps for each pollutant, the scaling surrogate used is well counts, according to equation 50:

Equation 50)

$$E_{GAP,\ i} = \left[(E_{CIP,\ i} + E_{kimray,i}) \times S_{well\ count}\right]_{gas\ wells} + \left[E_{CIP,\ i} \times S_{well\ count}\right]_{oil\ wells}$$

where:

$E_{GAP,\ i}$ is the annual county-wide emissions for pollutant i from gas-actuated pumps [ton/yr]
$E_{kimray,\ i}$ is the emissions from kimray pumps per well type (gas or oil) [ton/yr-well]
$E_{CIP,\ i}$ is the emissions from chemical injection pumps per well type (gas or oil) [ton/yr-well]
$S_{well\ count}$ is the number of active wells (gas or oil) in a particular county [wells]

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
ACT_GAS_KIM_CH4_VENT_RATE	Methane vent rate for gas wells using Kimray pumps	SCF/MMSCF	BASIN_FACTORS
ACT_GAS_KIM_AVG_GAS_PUMPED_WELL_YR	Average gas pumped per well annually with Kimray pumps per unit throughput	MMSCF/WELL/YR	BASIN_FACTORS
ACT_GAS_CIP_CH4_VENT_RATE	Methane vent rate for gas wells using CIP pumps	SCF/MMSCF	BASIN_FACTORS
ACT_GAS_CIP_HRS_OP	Average gas pumped per gas well annually with CIP pumps per unit throughput	MMSCF/WELL/YR	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
ACT_GAS_CIP_AVG_NUM_PUMP_WELL	Average number of CIP pumps per gas well	COUNT/WELL	BASIN_FACTORS
ACT_OIL_CIP_CH4_VENT_RATE	Methane vent rate for oil wells using CIP pumps	SCF/MMSCF	BASIN_FACTORS
ACT_OIL_CIP_HRS_OP	Average gas pumped per oil well annually with CIP pumps per unit throughput	MMSCF/WELL/YR	BASIN_FACTORS
ACT_OIL_CIP_AVG_NUM_PUMP_WELL	Average number of CIP pumps per oil well	COUNT/WELL	BASIN_FACTORS
ACT_GAS_MW_GAS	Molecular weight of the gas emitted by gas-actuated pumps at gas wells	G/MOL	BASIN_FACTORS
ACT_GAS_MOL_PCT_VOC	VOC fraction of gas emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_MOL_PCT_H2S	Hydrogen sulfide fraction of gas emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_MOL_PCT_CO2	Carbon dioxide fraction of gas emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_MOL_PCT_CH4	Methane fraction of gas emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_VOC_MW	Molecular weight of the VOC emitted by gas-actuated pumps at gas wells	G/MOL	BASIN_FACTORS
ACT_OIL_MW_GAS	Molecular weight of the gas emitted by gas-actuated pumps at gas wells	G/MOL	BASIN_FACTORS
ACT_OIL_MOL_PCT_VOC	VOC fraction of gas emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_MOL_PCT_H2S	Hydrogen sulfide fraction of gas emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_MOL_PCT_CO2	Carbon dioxide fraction of gas emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_MOL_PCT_CH4	Methane fraction of gas emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_VOC_MW	Molecular weight of the VOC emitted by gas-actuated pumps at oil wells	G/MOL	BASIN_FACTORS
ACT_OIL_BENZ_VOC	Benzene ratio to VOC being emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
ACT_OIL_ETHYLBENZ_VOC	Ethylbenzene ratio to VOC being emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_TOLUENE_VOC	Toluene ratio to VOC being emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_XYLENE_VOC	Xylene ratio to VOC being emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_METHANE_VOC	Methane ratio to VOC being emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_OIL_H2S	Hydrogen sulfide ratio to VOC being emitted by gas-actuated pumps at oil wells	Unitless	BASIN_FACTORS
ACT_GAS_BENZ_VOC	Benzene ratio to VOC being emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_ETHYLBENZ_VOC	Ethylbenzene ratio to VOC being emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_TOLUENE_VOC	Toluene ratio to VOC being emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_XYLENE_VOC	Xylene ratio to VOC being emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_METHANE_VOC	Methane ratio to VOC being emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS
ACT_GAS_H2S	Hydrogen sulfide ratio to VOC being emitted by gas-actuated pumps at gas wells	Unitless	BASIN_FACTORS

6.2.15 Mud Degassing

Calculation Sheets: MUD_DEG_GAS_2310121100; MUD_DEG_OIL_2310111100

Drilling mud degassing refers to the practice of extracting the entrained gas from the drilling mud once it is outside of the wellbore. During this process VOCs and methane (and other pollutants in the gas) are vented to the atmosphere. National default emissions factors for mud degassing are available from The Climate Registry Reporting Protocol:

Table 6-2. National default emissions factors for mud degassing by mud base.

Emission Source	Emission Factor Units[7]	Emission Factor Units[8]
Mud degassing – water-based mud	881.84 lbs THC / drilling day	0.2605 tonnes CH4/ drilling day
Mud degassing – oil-based mud	198.41 lbs THC / drilling day	0.0586 tonnes CH4/ drilling day
Mud degassing – synthetic mud	198.41 lbs THC / drilling day	0.0586 tonnes CH4/ drilling day

Water-based mud emissions factors were assumed as a default conservative value, but this parameter may be updated in the tool by the User with other factors in Table 6-2 or any basin-specific factor that may be available. This can be done in the EMISSIONS_FACTOR tab of the tool. To account for the use of different mud bases within a region, the methane emissions factor may be estimated as a weighted average based on a usage fraction of each mud type within a basin.

Applying the local-gas methane mass fraction to the mud degassing emission factors provides the site-representative emissions as shown in equation 51. Because the mud entrained gas is the gas coming out directly from the wellbore during drilling, produced gas compositions by well type are used to characterize these emissions. Equations 51-52 are applicable to both oil and gas wells mud degassing emissions, however gas compositions and surrogate values (spuds) will vary for each well type.

Equation 51)
$$E_{mud,vent,CH4} = N_{drill} \times EF_{mud,CH4} \times 1.102 \times \frac{M_{CH4}}{83.85}$$

where:

$E_{mud,vent,CH4}$ is the mud degassing emissions for methane per spud [ton/spud]
$EF_{mud,CH4}$ is the emissions factor for methane [ton CH4/drilling days]
N_{drill} is the number of drilling days per spud [drilling days/spud]
83.85 is the mole percent of methane from the vented gas used to derive the emissions factor (EF)
M_{CH4} is the mole percent of methane in the local gas vented during mud degassing [%] (if basin-specific methane emissions factor is used, M=83.85)
1.102 is the conversion of tonnes to short tons

To estimate emissions from other pollutants in the vented gas Equation 52 may be used:

[7] Wilson, Darcy, Richard Billings, Regi Oommen, and Roger Chang, Eastern Research Group, Inc. Year 2005 Gulfwide Emission Inventory Study, U.S. Department of the Interior, Minerals Management Services, Gulf of Mexico OCS Region, New Orleans, December 2007, Section 5.2.10.

[8] Based on gas content of 65.13 weight percent CH4, derived from sample data provided in the original source of the emission factors. Original sample data is as follows, in terms of mole%: 83.85% CH4, 5.41% C2H6, 6.12% C3H8, 3.21% C4H10, and 1.40% C5H12 (Wilson et al., 2007)

Equation 52) $$E_{mud,vent,i} = E_{mud,vent_{CH4}} \times \frac{MW_i}{MW_{CH4}} \times \frac{M_i}{M_{CH4}}$$

where:

$E_{mud,vent,i}$ is the mud degassing emissions for pollutant i per spud [ton/spud]
$EF_{mud,ven6,CH4}$ is the vented emissions for methane [ton CH4/spud]
MW_i is the molecular weight of pollutant i [lb/lb-mol]
MW_{CH4} is the molecular weight of methane [lb/lb-mol]
M_{CH4} is the mole percent of methane in the local gas vented during mud degassing [%]
M_i is the mole percent of pollutant in the local gas vented during mud degassing [%]

Extrapolation to county-level emissions

To estimate county-wide annual emissions, mud degassing emissions by spud are scaled with the county-wide count of drilling events (spuds), according to Equation 53:

Equation 53) $$E_{mud,vent,TOTAL\ \ i} = E_{mud,vent,\ \ i} \times S_{spuds}$$

where:

$E_{mud,vent,TOTAL,i}$ is the annual county-wide emissions for pollutant i from mud degassing [ton/yr]
$E_{mud,vent,\ i}$ is the emissions from mud degassing from a drilling event [ton/spud]
S_{spuds} is the number of wells drilled in a county for a particular year [spud/yr]

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
MUD_AVG_DRILL_DAYS_SPUD	Average number of drilling days per spud	DAYS/SPUD	BASIN_FACTORS
MUD_BASED_USED	Mud type	TYPE	BASIN_FACTORS
MUD_GAS_VOC_MOLAR	VOC molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_CO2_MOLAR	Carbon dioxide molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_CH4_MOLAR	Methane molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_H2S_MOLAR	Hydrogen sulfide molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_VOC_MW	Molecular weight of VOC in the degassed mud at gas wells	G/MOL	BASIN_FACTORS
MUD_OIL_VOC_MOLAR	VOC molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_CO2_MOLAR	Carbon dioxide molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
MUD_OIL_CH4_MOLAR	Methane molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_H2S_MOLAR	Hydrogen sulfide molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_VOC_MW	Molecular weight of VOC in the degassed mud at oil wells	G/MOL	BASIN_FACTORS
MUD_OIL_MOL_PCT_BENZ	Benzene molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_MOL_PCT_ETHYLBENZ	Ethylbenzene molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_MOL_PCT_TOLUENE	Toluene molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_MOL_PCT_XYLENE	Xylene molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_MOL_PCT_METHANE	Methane molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_OIL_MOL_PCT_VOC	VOC molar PCT Value of degassed mud at oil wells	Unitless	BASIN_FACTORS
MUD_GAS_MOL_PCT_BENZ	Benzene molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_MOL_PCT_ETHYLBENZ	Ethylbenzene molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_MOL_PCT_TOLUENE	Toluene molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_MOL_PCT_XYLENE	Xylene molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_MOL_PCT_METHANE	Methane molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS
MUD_GAS_MOL_PCT_VOC	VOC molar PCT Value of degassed mud at gas wells	Unitless	BASIN_FACTORS

6.2.16 Crude Oil Tanks

Calculation Sheet: CRUDE_OIL_TANKS_2310010200

Crude oil tank emissions are generated by working and breathing processes. The methodology for estimating oil tank venting emissions is shown in Equations 54-55. This methodology is based on a combined working and breathing losses VOC emissions factor on a per unit throughput basis (mass emissions per barrel of oil).

Equation 54) $$E_{oilt,\tan ks,VOC} = P_{oil} \times \frac{EF_{oil,tanks,VOC}}{2000} \times \left[1 - F \times C_{captured} \times C_{efficiency}\right]$$

where:

$E_{oil,tanks,VOC}$ is the county-wide annual VOC venting losses from oil tanks [tons-VOC/yr]
$EF_{oil,tank,VOC}$ is the VOC emissions factor for total losses from oil tanks [lb-VOC/bbl]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of oil tanks with flares
P_{oil} is the county-wide oil production [bbl/yr]
2000 is the unit conversion factor lb/ton

The methodology for estimating crude oil tank losses from other pollutants i in the working/breathing gas is shown below

Equation 55) $$E_{oil,tanks,i} = E_{oil,tanks,VOC} \times \frac{weight\ fraction_i}{weight\ fraction_{VOC}}$$

where:

$E_{oil,tanks,i}$ is the county-wide annual venting losses of pollutant i from oil tanks [tons/yr]
$E_{oil,tanks,VOC}$ is the county-wide annual VOC venting losses from oil tanks [tons-VOC/yr]
weight fraction is the mass-based concentration of pollutant i and VOC in the working/breathing gas

The methodology for estimating condensate tank combined losses from other pollutants i in the flashing gas is shown below

Equation 56) $$E_{condensate,tanks,i} = E_{condensate,tanks,VOC} \times \frac{weight\ fraction_i}{weight\ fraction_{VOC}}$$

where:

$E_{condensate,tanks,i}$ is the emissions of pollutant i per liquid unit throughput from condensate tanks [tons/bbl]
$E_{condensate,tanks,VOC}$ is the VOC emissions per liquid unit throughput from condensate tanks [tons/bbl]
weight fraction is the mass-based concentration of pollutant i and VOC in the flashing gas

Flaring emissions from oil tank controls

This source category includes any flaring emissions associated with controls applied to crude oil tanks. The methodology for estimating emissions from flaring of oil tank gas losses is described below:

Equation 57)

$$E_{flare,tank,i} = P_{countywide} \times \left(Q_{oil,tanks,flash} \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right) \times \frac{EF_i \times HV}{1000} \right) \Big/ 2000$$

where:

$E_{flare,tank}$ is the county-wide emissions from crude oil tank flaring [ton/yr]
$Q_{oil,tank,flash}$ is the volume of gas flared per unit of oil throughput [MCF/bbl]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of oil tanks with flares
EF_i is the flaring emissions factor for pollutant i [lb/MMBtu]
HV is the local heating value of the gas [BTU/SCF]
$P_{countywide}$ is the annual production of oil for a particular county [bbl/yr]
1000 is the unit conversion factor MCF/MMCF
2000 is the unit conversion factor lb/ton

The methodology for estimating SO_2 emissions from flaring of oil tank losses is shown below:

Equation 58)

$$E_{flare,tank,SO_2} = \left(\frac{P \times \left(Q_{oil,tanks,flash} \times F \times \left(C_{captured}\right) \times \left(C_{efficiency}\right) \times P_{countywide}\right)}{\left(R \big/ MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times f_{H_2S} \times 2 \big/ 907185$$

where:

$E_{flare,tank,SO_2}$ is the county-wide SO_2 emissions from flaring controls in oil tanks [ton/yr]
P is atmospheric pressure [1 atm]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
T is the atmospheric temperature [298 K]
f_{H_2S} is the mass fraction of H_2S in the gas
$Q_{oil,tank,flash}$ is the volume of gas vented per unit of oil throughput [MCF/bbl]
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
F is the fraction of crude oil tanks with flares
$P_{countywide}$ is the annual throughput of oil production for a particular county [bbl/yr]
3.5×10^{-5} is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

Equations 54-58 provide county-wide estimates directly using by-county oil production as a surrogate. The total county-wide emissions from crude oil tanks are the sum of flaring and crude tank working and breathing emissions (by-pollutant).

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
OIL_TANK_FRAC_TO_TANKS	Fraction of oil directed to tanks	Unitless	BASIN_FACTORS
OIL_TANK_FLARE_FRAC	Fraction of oil tanks with a flare	Unitless	BASIN_FACTORS
OIL_TANK_AVG_FLASH_LOSSES	Flashing emission factor VOC lost per barrel (BBL) of crude oil throughput	LB VOCS/BBL	BASIN_FACTORS
OIL_TANK_FLARE_CAPT_EFF	Capture Efficiency of the flare	Unitless	BASIN_FACTORS
OIL_TANK_FLARE_CONT_EFF	Control Efficiency of the flare	Unitless	BASIN_FACTORS
OIL_TANK_GAS_VENTING_RATE	Volume of flash gas vented per BBL of crude oil throughput	MCF/BBL	BASIN_FACTORS
OIL_TANK_LOCAL_HV	Heating value of the flared gas at the crude oil tank	BTU/SCF	BASIN_FACTORS
OIL_TANK_FRACT_H2S	Fraction of hydrogen sulfide in the flared gas at the crude oil tank	Unitless	BASIN_FACTORS
OIL_TANK_FRACT_VOC	Fraction of VOC in the flared gas at the crude oil tank	Unitless	BASIN_FACTORS
OIL_TANK_MW_GAS	Molecular weight of the flash gas being flared at the crude oil storage tank	G/MOL	BASIN_FACTORS
OIL_TANK_BENZ_VOC	Benzene fraction of VOC being emitted from crude oil storage tanks	Unitless	BASIN_FACTORS
OIL_TANK_ETHYLBENZ_VOC	Ethylbenzene fraction of VOC being emitted from crude oil storage tanks	Unitless	BASIN_FACTORS
OIL_TANK_TOLUENE_VOC	Toluene fraction of VOC being emitted from crude oil storage tanks	Unitless	BASIN_FACTORS
OIL_TANK_XYLENE_VOC	Xylene fraction of VOC being emitted from crude oil storage tanks	Unitless	BASIN_FACTORS
OIL_TANK_CH4_VOC	Methane ratio to VOC being emitted from crude oil storage tanks	Unitless	BASIN_FACTORS
OIL_TANK_H2S_VOC	Hydrogen sulfide ratio to VOC being emitted from crude oil storage tanks	Unitless	BASIN_FACTORS

6.2.17 Produced water tanks

Calculation Sheets: PROD_WATER_2310000550

Water tank emissions are generated by working and breathing processes. Because information on oil and gas field handling of produced water is limited, emissions from this source were assumed uncontrolled. The methodology for estimating water tank emissions is shown below

separately for gas wells and oil wells as water production and gas compositions for each well-type will differ:

Gas well water tanks:

Equation 59) $$E_{water,gaswells,i} = \frac{EF_{water,tanks,i}}{2000} \times S_{water,gas}$$

where:

$E_{water,tanks,\ i}$ is the county-wide annual emissions from water tanks located at gas wells [tons/yr]
$EF_{water,gas\ wells,i}$ is the emissions factor for pollutant i from working/breathing losses from water tanks in gas well sites [lb/bbl]
$S_{water,gas}$ is the county-wide annual production of water [bbl/yr] **from gas wells**
2000 is the unit conversion factor lbs/ton

Oil well water tanks:

Equation 60) $$E_{water,oilwells,i} = \frac{\left(EF_{water,LPwells,i} \times F + EF_{water,RPwells,i} \times (1-F)\right)}{2000} \times S_{water,oil}$$

where:

$E_{water,oil\ wells,i}$ is the county-wide annual emissions from water tanks located at oil wells [tons/yr]
$EF_{water,LP,i}$ is the emissions factor for pollutant i from working/breathing losses from water tanks at low pressure oil wells (i.e. wells with artificial lifts) [lb/bbl]
$EF_{water,LP,i}$ is the emissions factor for pollutant i from working/breathing losses from water tanks at regular pressure oil well sites [lb/bbl]
F is the fraction of water production from oil wells with artificial lifts
$S_{water,oil}$ is the county-wide annual production of water [bbl/yr] **from oil wells**
2000 is the unit conversion factor lbs/ton

To estimate emissions from other pollutants in the losses from water tanks, the following equation may be used:

Equation 61) $$E_{water,wells,i} = E_{water,wells_{CH4}} \times \frac{MW_i}{MW_{CH4}} \times \frac{M_i}{M_{CH4}}$$

where:

$E_{\ water,wells,i}$ is the water tank county-wide venting losses of pollutant i from water tanks at particular well type (oil or gas) [ton/yr]
$EF_{water,wells,CH4}$ is the water tank emissions for methane for a particular well type [ton CH4/yr]
MW_i is the molecular weight of pollutant i [lb/lb-mol]

MW_{CH4} is the molecular weight of methane [lb/lb-mol]
M_{CH4} is the mole percent of methane in the water tanks gas (local produced gas) [%]
M_i is the mole percent of pollutant in the water tanks gas (local produced gas) [%]

Extrapolation to county-level emissions

County-wide emissions from produced water tanks are estimated directly from equations 59 through 61. The sum of oil wells and gas wells water tank emissions yield total county-wide emissions from water tanks.

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
PROD_WATER_FRACT_TANK	Fraction of produced water sent to tanks	Unitless	BASIN_FACTORS
PROD_WATER_AVG_LOSS_GAS WELLS	Average Methane losses from gas wells	LB/BBL	BASIN_FACTORS
PROD_WATER_WELLS_ART_LIFT_OIL WELLS	Fraction of low pressure oil wells, i.e. fraction of wells with artificial lifts	Unitless	BASIN_FACTORS
PROD_WATER_AVG_LOSS_LP_OIL WELLS	Average Methane losses from Low Pressure oil wells	LB/BBL	BASIN_FACTORS
PROD_WATER_AVG_LOSS_REG_OIL WELLS	Average Methane losses from Regular Pressure oil wells	LB/BBL	BASIN_FACTORS
PROD_WATER_GASWELL_VOC_MOLAR	VOC molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GASWELL_CO2_MOLAR	Carbon dioxide molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GASWELL_CH4_MOLAR	Methane molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GASWELL_H2S_MOLAR	Hydrogen sulfide molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GASWELL_VOC_MW	Molecular weight of VOC in the produced water at gas wells	G/MOL	BASIN_FACTORS
PROD_WATER_OILWELL_VOC_MOLAR	VOC molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OILWELL_CO2_MOLAR	Carbon dioxide molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OILWELL_CH4_MOLAR	Methane molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OILWELL_H2S_MOLAR	Hydrogen sulfide molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OILWELL_VOC_MW	Molecular weight of VOC in the produced water at oil wells	G/MOL	BASIN_FACTORS
PROD_WATER_OIL_MOL_PCT_BENZ	Benzene molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
PROD_WATER_OIL_MOL_PCT_ETHYLBENZ	Ethylbenzene molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OIL_MOL_PCT_TOLUENE	Toluene molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OIL_MOL_PCT_XYLENE	Xylene molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OIL_MOL_PCT_METHANE	Methane molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_OIL_MOL_PCT_VOC	VOC molar PCT Value of produced water at oil wells	Unitless	BASIN_FACTORS
PROD_WATER_GAS_MOL_PCT_BENZ	Benzene molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GAS_MOL_PCT_ETHYLBENZ	Ethylbenzene molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GAS_MOL_PCT_TOLUENE	Toluene molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GAS_MOL_PCT_XYLENE	Xylene molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GAS_MOL_PCT_METHANE	Methane molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS
PROD_WATER_GAS_MOL_PCT_VOC	VOC molar PCT Value of produced water at gas wells	Unitless	BASIN_FACTORS

6.2.18 Casinghead gas venting

Calculation sheets: CASING_HEAD_GAS_2310011000

This section refers to the practice of venting associated gas from oil wells which sometimes takes place when the well is not connected to a gas sales pipeline or when amount of gas produced by the well is so limited that is not profitable for capture. The calculation methodology for estimating basin-wide emissions from casing gas vented is shown below in Equation 62:

Equation 62) $$E_{casing,gas,i} = \left(\frac{P \times \left(Q_{casing,gas}\right) \times S_{oil}}{\left(R / MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times \frac{f_i}{907185} \times \left(1 - F_{flare} \times C_{captured} \times C_{efficiency}\right)$$

where:

- $E_{casing,gas,i}$ is the county-wide emissions of pollutant *i* from casing gas venting [ton/bbl]
- *P* is atmospheric pressure [1 atm]
- $Q_{casing,gas,i}$ is the venting rate of casing gas per unit of oil production [MCF/bbl]

R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
T is the atmospheric temperature [298 K]
f_i is the mass fraction of pollutant i in the casing gas
S_{oil} is the annual county-wide production of oil [bbl/yr]
F_{flare} is the fraction of casing gas vent controlled with flares
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
3.5×10^{-5} is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton

Flaring emissions from casing gas controls

Emissions from flaring controls applied to casing head gas are included in this source category. The methodology for estimating emissions from flaring of casing gas is described below:

Equation 63) $$E_{casing,gas,i} = \left(\frac{EF_i \times Q_{casing,gas} \times F \times (C_{captured}) \times (C_{efficiency}) \times HV}{1000} \times S_{oil} \right) \Big/ 2000$$

where:

$E_{flare,casing,gas}$ is the county-wide flaring emissions of pollutant i from vented casing gas [ton/yr]
EF_i is the flaring emissions factor for pollutant i [lb/MMBtu]
$Q_{casing,gas}$ is the volume of casing gas vented per barrel of oil produced [MCF/bbl]
HV is the local heating value of the gas [BTU/SCF]
S_{oil} is the annual county-wide production of oil [bbl/yr]
F is the fraction of casing gas vent controlled with flares
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
2000 is the unit conversion factor lbs/ton

The methodology for estimating SO_2 emissions from flaring of casing head gas is shown below:

Equation 64)

$$E_{casing,flare,SO_2} = \left(\frac{P \times (Q_{casing,gas}) \times S_{oil}}{\left(R \big/ MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times 2 \times \frac{f_{SO_2}}{907185} \times F_{flare} \times (C_{captured}) \times (C_{efficiency})$$

where:

$E_{casing,flare,SO_2}$ is the county-wide SO_2 emissions from flaring of casing gas [ton/yr]
P is atmospheric pressure [1 atm]

$Q_{casing,gas}$ is vented volume of casing gas per barrel of oil [MCF/bbl]
S_{oil} is the annual county-wide production of oil [bbl/yr]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the casing gas [g/mol]
T is the atmospheric temperature [298 K]
f_{H_2S} is the mass fraction of H_2S in the casing gas
F is the fraction of casing gas vents controlled by flare
$C_{capture}$ is the capture efficiency of the flare
$C_{efficiency}$ is the control efficiency of the flare
$3.5x10^{-5}$ is the unit conversion factor MCF/L
907185 is the unit conversion factor g/ton

Extrapolation to county-level emissions

County-wide emissions from casing gas venting and casing gas flaring are estimated directly from Equations 62-64. The sum of venting and flaring emissions by pollutant yield the total county-wide emissions from casing head gas that is not captured for sale.

Source category data fields within the tool

FIELD	FIELD DESCRIPTION	Units	WORKSHEET TAB
CASING_GAS_VENTING_RATE	Venting rate of casing gas per unit of oil production throughput	MCF/BBL	BASIN_FACTORS
CASING_GAS_FRACT_VENTS_CONT	Fraction of casing gas vent controlled with flares	Unitless	BASIN_FACTORS
CASING_GAS_FLARING_CONT_EFF	Control Efficiency of the flare	Unitless	BASIN_FACTORS
CASING_GAS_FLARING_CAPTURE_EFF	Capture Efficiency of the flare	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_VOC	Fraction of VOC in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_H2S	Fraction of Hydrogen sulfide in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_CO	Fraction of CO in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_CH4	Fraction of Methane in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_BENZ	Fraction of Benzene in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_ETHYLBENZ	Fraction of Ethylbenzene in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_TOLUENE	Fraction of Toluene in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_WT_FRACT_XYLENE	Fraction of Xylene in the vented casing gas	Unitless	BASIN_FACTORS
CASING_GAS_LHV	Heating value of the vented casing gas	BTU/SCF	BASIN_FACTORS
CASING_GAS_MW	Molecular weight of the vented casing gas	G/MOL	BASIN_FACTORS

6.3 Output Emissions Summary

The nonpoint emission estimates from each worksheet is linked to a “compiled_emissions” worksheet, which contains the entire emissions inventory for the state. At this point, the user can simply upload this tab into a database program for further data analysis. The information in the “compiled_emissions” worksheet is then fed to summary Pivot tables, which provides easy-to-use summaries of source category emissions, geographic emissions, and activity data. These worksheet tabs are:

- EMISSIONS_SUMMARY_GEOGRAPHIC
- EMISSIONS_SUMMARY_SOURCE
- ACTIVITY_SUMMARY_GEOGRAPHIC

The information in the “compiled_emissions” worksheet are also fed into four worksheet tabs relating to the EPA’s Emission Inventory System (EIS) data submittal for nonpoint sources. The EIS staging tables for nonpoint sources can be found in “Nonpoint Inventory – April 2012” at http://www.epa.gov/ttn/chief/eidocs/training.html#eis.

6.4 Formatting tool for NEI submission

Within each workbook, selected information in the “compiled_emissions” worksheet are also fed into four worksheet tabs relating to the EPA’s Emission Inventory System (EIS) data submittal for nonpoint sources. The EIS staging tables for nonpoint sources can be found in “Nonpoint Inventory – April 2012” at http://www.epa.gov/ttn/chief/eidocs/training.html#eis. Although there are 13 tables relating to the nonpoint staging tables, EPA requires that the following four data tables need to be submitted:

- Emissions
- EmissionProcess
- ReportingPeriod
- Location

The User can simply import the information from these four tabs into their emission inventory database program to generate the XML files needed for submittal. As a way to check the format of these EIS tables, a sample output XML file from one of the states’ tools was submitted to the EIS QA environment, and passed through the system checks without any issues.

7.0 RESULTS

7.1 2011 Oil and Gas Area Source Emissions

Emissions estimates were compiled from each State's tool to arrive at the basin-wide inventories for the oil and gas regions within the CenSARA domain. Emissions were collected from the 'compiled_emissions' tab in each of the tools and combined in a Microsoft Access database to aggregate emissions from each State and allocate them in equivalent basin and source category bins. Emissions inventories developed in this work are highly detailed in their geographical specificity (detail by basin, state and county), in the array of pollutants included (16 total) and the number of source categories analyzed (18 area sources, 34 SCCs). Hence, for the purpose of summarizing results in this report, only key pollutants relevant to air quality issues of interest to CenSARA will be highlighted. For more detailed emissions, the User can manipulate the pivot table summaries within each tool to display emissions in the desired groupings.

Basin-wide emissions by source are shown in Table 7-1 for selected pollutants including the major criteria pollutants (NOx, VOC, CO, PM_{10}, $PM_{2.5}$, SO_2), hydrogen sulfide (H_2S), total HAPs (a combination of benzene, ethylbenzene, toluene, xylene, formaldehyde and n-hexane) and methane (CH_4).

Following Table 7-1, the distribution of total CenSARA domain emissions allocated by State, and by each basin within a CenSARA state is shown in Table 7-2.

As stated earlier in this report, the following data should be considered preliminary. As the states complete their QA/QC and take into consideration additional information (ex: applicable control measures), there will likely be changes. Each state should be contacted regarding what it has been ultimately reported to the NEI.

Table 7-1. Basin-wide emissions by area source category for 2011 in the CenSARA domain.

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Anadarko Basin	108,951.8	133,644.6	273,065.5	89.1	3,767.9	3,761.5	48.9	4,087.6	708,482.8
Artificial Lift Engines	9,028.4	13,960.2	117.7	2.3	77.2	77.2	-	90.9	914.8
Blowdowns	-	-	38,738.4	10.7	-	-	-	77.0	99,343.0
Casinghead Gas Venting	-	-	738.8	0.0	-	-	-	-	2,964.2
Condensate Tanks	196.8	1,040.5	10,201.2	-	-	-	-	306.3	6,664.9
Crude Oil Tanks	0.0	0.2	13,377.2	-	-	-	-	25.9	79.4
Dehydrators	0.0	0.0	1,545.3	-	0.0	0.0	-	587.2	2,024.3
Drill Rigs	4,899.3	1,116.7	308.2	8.5	191.1	186.1	-	38.4	5.0
Fugitives	-	-	17,828.3	-	-	-	4.0	26.3	50,765.0
Gas-Actuated Pumps	-	-	8,735.9	-	-	-	2.2	16.0	23,384.4
Heaters	20,686.5	17,376.6	1,137.8	0.0	1,572.2	1,572.2	-	159.3	475.8
Hydraulic Fracturing	1,126.1	254.5	71.1	1.9	43.8	42.5	-	8.9	1.2
Lateral/Gathering Line Compressors	22,250.0	31,625.1	876.4	18.8	592.5	592.5	-	730.9	10,400.2
Loading Emissions	-	-	1,063.0	-	-	-	0.0	14.0	149.4
Mud Degassing	-	-	8,419.7	-	-	-	1.3	8.8	27,383.9
Pneumatic Devices	-	-	166,568.8	-	-	-	41.2	294.8	453,681.8
Produced Water	-	-	772.3	-	-	-	0.2	1.5	2,006.1
Well Completions	96.1	507.8	128.8	4.5	-	-	-	54.9	71.5
Wellhead Compressor Engines	50,668.6	67,763.0	2,436.7	42.4	1,291.0	1,291.0	-	1,646.6	28,168.1
Arkoma Basin	15,615.5	12,461.8	16,273.7	17.2	428.6	425.3	3.5	340.8	294,226.3
Artificial Lift Engines	866.4	1,339.7	11.3	0.2	7.4	7.4	-	8.7	87.8
Blowdowns	-	-	3,911.6	0.3	-	-	-	-	99,372.0

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Casinghead Gas Venting	-	-	-	-	-	-	-	-	-
Condensate Tanks	1.0	5.2	38.2	-	-	-	-	0.6	56.3
Crude Oil Tanks	-	-	1,357.6	5.6	-	-	-	63.9	180.6
Dehydrators	0.0	0.0	14.2	-	0.0	0.0	-	11.6	14.6
Drill Rigs	1,221.0	286.7	74.9	2.3	48.1	46.8	-	9.3	1.2
Fugitives	-	-	1,368.4	-	-	-	1.1	-	13,460.9
Gas-Actuated Pumps	-	-	707.7	-	-	-	0.6	-	5,724.0
Heaters	2,473.3	2,077.6	136.0	0.0	188.0	188.0	-	19.0	56.9
Hydraulic Fracturing	1,688.9	381.7	106.6	2.9	65.7	63.7	-	13.3	1.7
Lateral/Gathering Line Compressors	3,003.5	2,403.9	300.3	1.8	37.7	37.7	-	71.1	3,172.0
Loading Emissions	-	-	7.5	-	-	-	0.0	0.0	0.1
Mud Degassing	-	-	341.4	-	-	-	0.1	-	6,162.2
Pneumatic Devices	-	-	7,043.5	-	-	-	1.6	-	158,096.8
Produced Water	-	-	-	-	-	-	-	-	-
Well Completions	1.2	6.4	315.7	0.5	-	-	-	0.7	2,158.5
Wellhead Compressor Engines	6,360.2	5,960.7	538.9	3.7	81.7	81.7	-	142.4	5,680.7
Bend Arch-Fort Worth Basin	144,032.1	189,210.9	147,646.4	1,667.3	2,468.9	2,464.8	1,106	3,099.4	458,542.4
Artificial Lift Engines	8,596.6	13,292.6	112.1	2.2	73.5	73.5	-	86.6	871.0
Blowdowns	-	-	12,307.2	1.0	-	-	-	32.5	60,509.5
Casinghead Gas Venting	0.1	0.4	1,042.2	1,062.0	-	-	-	5.0	1,457.1
Condensate Tanks	19.1	101.1	12,544.2	-	-	-	-	135.0	5,045.4
Crude Oil Tanks	1.2	6.6	13,093.3	487.4	-	-	-	317.1	1,832.8
Dehydrators	0.0	0.0	81.6	-	0.0	0.0	-	26.9	427.6
Drill Rigs	3,539.4	859.3	213.3	6.8	140.9	137.0	-	26.5	3.5

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Fugitives	-	-	14,693.9	-	-	-	268.1	76.8	37,108.9
Gas-Actuated Pumps	-	-	5,114.4	-	-	-	68.8	23.0	12,994.7
Heaters	10,873.8	9,134.0	598.1	0.1	826.4	826.4	-	83.7	250.1
Hydraulic Fracturing	199.2	45.0	12.6	0.3	7.8	7.5	-	1.6	0.2
Lateral/Gathering Line Compressors	8,631.4	12,391.0	246.4	3.1	91.6	91.6	-	120.7	2,397.8
Loading Emissions	-	-	255.7	-	-	-	0.0	3.1	7.4
Mud Degassing	-	-	2,735.0	-	-	-	23.9	10.0	8,791.6
Pneumatic Devices	-	-	74,054.9	-	-	-	729.2	286.8	259,451.4
Produced Water	-	-	4,407.0	-	-	-	16.0	13.2	17,832.4
Well Completions	13.9	73.3	1,853.6	57.3	-	-	-	14.9	6,151.0
Wellhead Compressor Engines	112,157.3	153,307.6	4,281.0	47.2	1,328.7	1,328.7	-	1,836.0	43,410.0
Cambridge Arch-Central Kansas Uplift	9,339.9	11,728.8	39,793.7	2.4	282.8	282.5	0.0	209.7	86,424.4
Artificial Lift Engines	1,413.7	2,186.0	18.4	0.4	12.1	12.1	-	14.2	143.2
Blowdowns	-	-	542.9	-	-	-	-	0.2	9,202.2
Casinghead Gas Venting	0.1	0.7	713.2	-	-	-	-	0.1	1,364.3
Condensate Tanks	-	-	8,418.8	-	-	-	-	40.5	1,929.2
Crude Oil Tanks	-	-	3,039.6	-	-	-	-	73.4	425.4
Dehydrators	0.0	0.0	0.8	-	0.0	0.0	-	0.7	0.9
Drill Rigs	246.6	66.3	13.4	0.6	10.2	9.9	-	1.7	0.2
Fugitives	-	-	5,612.6	-	-	-	-	0.0	12,739.3
Gas-Actuated Pumps	-	-	1,418.7	-	-	-	-	0.0	3,412.7
Heaters	2,868.6	2,409.6	157.8	-	218.0	218.0	-	22.1	66.0
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Lateral/Gathering Line Compressors	917.6	1,272.4	32.8	0.3	8.4	8.4	-	12.0	319.5
Loading Emissions	-	-	69.6	-	-	-	0.0	0.9	0.5
Mud Degassing	-	-	547.1	-	-	-	-	0.0	1,141.8
Pneumatic Devices	-	-	18,732.4	-	-	-	-	0.3	52,516.8
Produced Water	-	-	112.8	-	-	-	-	0.0	1,799.0
Well Completions	-	-	279.8	-	-	-	-	0.0	619.1
Wellhead Compressor Engines	3,893.3	5,793.8	82.9	1.1	34.1	34.1	-	43.5	744.3
Cherokee Platform	36,316.4	48,490.0	73,950.7	567.4	791.4	791.1	620.1	901.9	240,037.0
Artificial Lift Engines	10,550.7	16,314.0	137.6	2.7	90.2	90.2	-	106.2	1,069.0
Blowdowns	-	-	7,665.4	0.6	-	-	-	20.2	37,687.6
Casinghead Gas Venting	0.0	0.1	354.3	361.1	-	-	-	1.7	495.4
Condensate Tanks	3.9	20.4	2,528.4	-	-	-	-	27.2	1,016.9
Crude Oil Tanks	0.4	2.2	4,451.6	165.7	-	-	-	107.8	623.1
Dehydrators	0.0	0.0	59.2	-	0.0	0.0	-	48.5	60.9
Drill Rigs	171.5	53.9	9.5	0.4	7.3	7.1	-	1.1	0.1
Fugitives	-	-	8,216.3	-	-	-	144.8	42.2	21,427.0
Gas-Actuated Pumps	-	-	2,898.4	-	-	-	37.1	12.8	7,650.2
Heaters	6,193.6	5,202.6	340.6	0.0	470.7	470.7	-	47.7	142.5
Hydraulic Fracturing	1.1	0.2	0.1	0.0	0.0	0.0	-	0.0	0.0
Lateral/Gathering Line Compressors	5,375.9	7,717.6	153.5	1.9	57.1	57.1	-	75.2	1,493.5
Loading Emissions	-	-	55.4	-	-	-	0.0	0.7	1.6
Mud Degassing	-	-	2,538.3	-	-	-	44.3	12.1	4,564.3
Pneumatic Devices	-	-	43,364.8	-	-	-	393.9	163.8	156,710.8

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Produced Water	-	-	-	-	-	-	-	-	-
Well Completions	4.0	21.3	642.5	29.1	-	-	-	5.3	1,669.6
Wellhead Compressor Engines	14,015.3	19,157.5	535.0	5.9	166.0	166.0	-	229.4	5,424.6
Denver Basin	1,547.2	2,203.1	7,693.4	0.4	20.8	20.8	0.2	52.4	11,984.2
Artificial Lift Engines	5.7	8.8	0.1	0.0	0.0	0.0	-	0.1	0.6
Blowdowns	-	-	161.8	-	-	-	-	0.0	2,741.9
Casinghead Gas Venting	0.0	0.0	16.1	-	-	-	-	0.0	30.7
Condensate Tanks	-	-	6,735.8	-	-	-	-	32.4	1,543.6
Crude Oil Tanks	-	-	68.5	-	-	-	-	1.7	9.6
Dehydrators	0.0	0.0	0.1	-	0.0	0.0	-	0.1	0.1
Drill Rigs	3.5	0.9	0.2	0.0	0.1	0.1	-	0.0	0.0
Fugitives	-	-	61.8	-	-	-	-	0.0	714.7
Gas-Actuated Pumps	-	-	93.4	-	-	-	0.2	0.0	245.1
Heaters	104.5	87.8	5.7	0.0	7.9	7.9	-	0.8	2.4
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-
Lateral/Gathering Line Compressors	273.4	379.1	9.8	0.1	2.5	2.5	-	3.6	95.2
Loading Emissions	-	-	54.3	-	-	-	0.0	0.7	0.4
Mud Degassing	-	-	4.2	-	-	-	-	-	8.0
Pneumatic Devices	-	-	401.8	-	-	-	-	0.1	5,737.6
Produced Water	-	-	45.8	-	-	-	-	-	614.4
Well Completions	-	-	9.5	-	-	-	-	-	18.1
Wellhead Compressor Engines	1,160.1	1,726.3	24.7	0.3	10.2	10.2	-	13.0	221.8
East Texas Basin	128,840.1	171,678.3	100,631.5	944.4	1,975.3	1,972.9	439.8	3,417.4	364,708.0
Artificial Lift Engines	3,576.3	5,529.9	46.6	0.9	30.6	30.6	-	36.0	362.4

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Blowdowns	-	-	11,445.5	0.9	-	-	-	30.2	56,273.2
Casinghead Gas Venting	0.0	0.2	591.8	603.0	-	-	-	2.8	827.5
Condensate Tanks	13.5	71.4	8,858.4	-	-	-	-	95.3	3,562.9
Crude Oil Tanks	0.7	3.7	7,435.2	276.8	-	-	-	180.0	1,040.8
Dehydrators	0.0	0.0	1,491.3	-	0.0	0.0	-	879.9	417.6
Drill Rigs	2,023.6	517.8	120.1	4.0	81.6	79.3	-	14.8	1.9
Fugitives	-	-	7,691.6	-	-	-	107.5	35.3	23,747.5
Gas-Actuated Pumps	-	-	2,923.5	-	-	-	27.6	11.5	9,254.1
Heaters	6,415.7	5,389.2	352.9	0.0	487.6	487.6	-	49.4	147.6
Hydraulic Fracturing	60.1	13.6	3.8	0.1	2.3	2.3	-	0.5	0.1
Lateral/Gathering Line Compressors	8,027.1	11,523.5	229.2	2.9	85.2	85.2	-	112.3	2,230.0
Loading Emissions	-	-	405.4	-	-	-	0.0	4.6	12.1
Mud Degassing	-	-	916.9	-	-	-	3.4	2.8	3,700.4
Pneumatic Devices	-	-	51,252.8	-	-	-	293.6	171.8	210,096.9
Produced Water	-	-	2,237.4	-	-	-	7.7	6.7	9,119.9
Well Completions	4.0	21.1	479.4	10.0	-	-	-	3.8	1,834.0
Wellhead Compressor Engines	108,719.1	148,607.9	4,149.7	45.8	1,288.0	1,288.0	-	1,779.7	42,079.2
Forest City Basin	4,344.9	6,090.1	8,186.2	1.1	89.2	89.1	11.5	58.7	19,014.8
Artificial Lift Engines	3,032.0	4,688.3	39.5	0.8	25.9	25.9	-	30.5	307.2
Blowdowns	-	-	58.2	-	-	-	-	0.1	298.0
Casinghead Gas Venting	0.0	0.0	29.9	-	-	-	-	0.0	66.5
Condensate Tanks	-	-	142.2	-	-	-	-	0.7	32.6
Crude Oil Tanks	-	-	180.2	-	-	-	-	4.4	25.2
Dehydrators	0.0	0.0	0.3	-	0.0	0.0	-	0.3	0.3

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Drill Rigs	47.8	12.8	2.6	0.1	2.0	1.9	-	0.3	0.0
Fugitives	-	-	1,493.1	-	-	-	-	1.7	3,413.5
Gas-Actuated Pumps	-	-	395.6	-	-	-	11.5	0.5	854.2
Heaters	745.8	626.5	41.0	0.0	56.7	56.7	-	5.7	17.2
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-
Lateral/Gathering Line Compressors	101.6	140.9	3.6	0.0	0.9	0.9	-	1.3	35.4
Loading Emissions	-	-	1.4	-	-	-	0.0	0.0	0.0
Mud Degassing	-	-	534.8	-	-	-	-	1.7	1,028.1
Pneumatic Devices	-	-	5,093.1	-	-	-	-	6.5	12,458.4
Produced Water	-	-	24.1	-	-	-	-	0.0	92.5
Well Completions	-	-	137.5	-	-	-	-	0.2	305.9
Wellhead Compressor Engines	417.7	621.5	8.9	0.1	3.7	3.7	-	4.7	79.8
Illinois Basin	15.3	13.5	15.6	0.0	0.4	0.4	0.0	0.3	372.7
Artificial Lift Engines	-	-	-	-	-	-	-	-	-
Blowdowns	-	-	5.1	0.0	-	-	-	-	130.0
Casinghead Gas Venting	-	-	-	-	-	-	-	-	-
Condensate Tanks	-	-	-	-	-	-	-	-	-
Crude Oil Tanks	-	-	-	-	-	-	-	-	-
Dehydrators	0.0	0.0	0.0	-	0.0	0.0	-	0.0	0.0
Drill Rigs	-	-	-	-	-	-	-	-	-
Fugitives	-	-	0.7	-	-	-	0.0	-	17.2
Gas-Actuated Pumps	-	-	0.4	-	-	-	-	-	7.3
Heaters	3.1	2.6	0.2	0.0	0.2	0.2	-	0.0	0.1
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Lateral/Gathering Line Compressors	3.9	3.1	0.4	0.0	0.0	0.0	-	0.1	4.2
Loading Emissions	-	-	-	-	-	-	-	-	-
Mud Degassing	-	-	-	-	-	-	-	-	-
Pneumatic Devices	-	-	8.1	-	-	-	0.0	-	206.5
Produced Water	-	-	-	-	-	-	-	-	-
Well Completions	-	-	-	-	-	-	-	-	-
Wellhead Compressor Engines	8.3	7.8	0.7	0.0	0.1	0.1	-	0.2	7.4
Louisiana-Mississippi Salt Basins	39,831.9	49,055.7	40,340.8	458.7	1,053.9	1,050.6	1,404	1,726.2	158,600.9
Artificial Lift Engines	2,880.0	4,453.3	37.6	0.7	24.6	24.6	-	29.0	291.8
Blowdowns	-	-	825.9	-	-	-	-	8.9	5,353.5
Casinghead Gas Venting	-	-	-	-	-	-	-	-	-
Condensate Tanks	2.2	11.8	2,679.1	-	-	-	-	40.3	209.8
Crude Oil Tanks	-	-	2,118.9	308.8	-	-	-	25.4	513.0
Dehydrators	0.0	0.0	613.7	-	0.0	0.0	-	503.3	632.2
Drill Rigs	3,061.7	704.9	192.1	5.3	119.7	116.5	-	23.9	3.1
Fugitives	-	-	5,838.1	-	-	-	421.9	156.8	17,901.9
Gas-Actuated Pumps	-	-	1,886.1	-	-	-	108.9	44.6	7,080.8
Heaters	8,349.7	7,013.8	459.2	0.1	634.6	634.6	-	64.3	192.0
Hydraulic Fracturing	70.1	15.8	4.4	0.1	2.7	2.6	-	0.6	0.1
Lateral/Gathering Line Compressors	10,066.5	15,565.4	131.3	2.6	86.1	86.1	-	101.4	1,020.0
Loading Emissions	-	-	164.6	-	-	-	0.0	2.2	1.2
Mud Degassing	-	-	360.5	-	-	-	23.6	9.3	1,223.1
Pneumatic Devices	-	-	22,961.1	-	-	-	790.2	423.9	111,484.9

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Produced Water	-	-	1,453.1	-	-	-	59.6	29.4	6,605.2
Well Completions	10.1	53.6	19.9	134.3	-	-	-	6.0	30.8
Wellhead Compressor Engines	15,391.5	21,237.2	595.2	6.6	186.1	186.1	-	257.0	6,057.7
Marathon Thrust Belt	3,863.2	5,585.2	4,525.2	1.6	51.9	51.9	0.5	64.8	13,172.8
Artificial Lift Engines	2.3	3.5	0.0	0.0	0.0	0.0	-	0.0	0.2
Blowdowns	-	-	906.4	-	-	-	-	-	2,607.9
Casinghead Gas Venting	-	-	-	-	-	-	-	-	-
Condensate Tanks	0.3	1.4	236.8	-	-	-	-	2.5	95.2
Crude Oil Tanks	0.0	0.0	2.5	0.1	-	-	-	0.1	0.3
Dehydrators	0.0	0.0	10.5	-	0.0	0.0	-	5.1	11.8
Drill Rigs	21.9	5.0	1.4	0.0	0.9	0.8	-	0.2	0.0
Fugitives	-	-	152.8	-	-	-	0.1	-	440.5
Gas-Actuated Pumps	-	-	28.0	-	-	-	0.1	-	208.9
Heaters	90.9	76.4	5.0	0.0	6.9	6.9	-	0.7	2.1
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-
Lateral/Gathering Line Compressors	232.3	333.5	6.6	0.1	2.5	2.5	-	3.2	64.5
Loading Emissions	-	-	5.4	-	-	-	0.0	0.1	0.2
Mud Degassing	-	-	13.9	-	-	-	0.2	0.2	41.8
Pneumatic Devices	-	-	3,058.3	-	-	-	0.2	-	8,801.3
Produced Water	-	-	9.4	-	-	-	0.0	0.1	32.2
Well Completions	-	-	-	-	-	-	-	-	-
Wellhead Compressor Engines	3,515.6	5,165.6	88.2	1.4	41.7	41.7	-	52.7	865.8
Nemaha Uplift	9,081.4	12,867.0	22,701.9	2.3	158.1	158.0	14.9	192.3	43,783.4
Artificial Lift Engines	3,933.2	6,081.8	51.3	1.0	33.6	33.6	-	39.6	398.5

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Blowdowns	-	-	443.3	-	-	-	-	0.9	2,268.4
Casinghead Gas Venting	0.0	0.1	103.9	-	-	-	-	0.1	231.1
Condensate Tanks	-	-	8,578.0	-	-	-	-	41.3	1,965.7
Crude Oil Tanks	-	-	626.7	-	-	-	-	15.1	87.7
Dehydrators	0.0	0.0	26.3	-	0.0	0.0	-	21.5	27.1
Drill Rigs	39.2	10.5	2.1	0.1	1.6	1.6	-	0.3	0.0
Fugitives	-	-	2,187.0	-	-	-	-	2.7	5,735.0
Gas-Actuated Pumps	-	-	679.2	-	-	-	14.9	1.0	1,662.1
Heaters	1,156.9	971.8	63.6	0.0	87.9	87.9	-	8.9	26.6
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-
Lateral/Gathering Line Compressors	773.3	1,072.3	27.6	0.3	7.1	7.1	-	10.1	269.2
Loading Emissions	-	-	78.3	-	-	-	0.0	1.0	0.6
Mud Degassing	-	-	88.3	-	-	-	-	0.3	179.5
Pneumatic Devices	-	-	9,067.3	-	-	-	-	13.2	28,750.1
Produced Water	-	-	-	-	-	-	-	-	-
Well Completions	-	-	611.2	-	-	-	-	0.8	1,574.0
Wellhead Compressor Engines	3,178.8	4,730.6	67.7	0.9	27.9	27.9	-	35.5	607.7
Ozark Uplift	-	-	-	-	-	-	-	-	-
Artificial Lift Engines	-	-	-	-	-	-	-	-	-
Blowdowns	-	-	-	-	-	-	-	-	-
Casinghead Gas Venting	-	-	-	-	-	-	-	-	-
Condensate Tanks	-	-	-	-	-	-	-	-	-
Crude Oil Tanks	-	-	-	-	-	-	-	-	-
Dehydrators	-	-	-	-	-	-	-	-	-

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Drill Rigs	-	-	-	-	-	-	-	-	-
Fugitives	-	-	-	-	-	-	-	-	-
Gas-Actuated Pumps	-	-	-	-	-	-	-	-	-
Heaters	-	-	-	-	-	-	-	-	-
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-
Lateral/Gathering Line Compressors	-	-	-	-	-	-	-	-	-
Loading Emissions	-	-	-	-	-	-	-	-	-
Mud Degassing	-	-	-	-	-	-	-	-	-
Pneumatic Devices	-	-	-	-	-	-	-	-	-
Produced Water	-	-	-	-	-	-	-	-	-
Well Completions	-	-	-	-	-	-	-	-	-
Wellhead Compressor Engines	-	-	-	-	-	-	-	-	-
Palo Duro Basin	5,879.2	7,884.9	6,570.0	206.9	94.8	94.7	37.8	159.7	17,978.0
Artificial Lift Engines	289.2	447.2	3.8	0.1	2.5	2.5	-	2.9	29.3
Blowdowns	-	-	530.9	0.0	-	-	-	1.4	2,610.3
Casinghead Gas Venting	0.0	0.1	136.8	139.4	-	-	-	0.7	191.3
Condensate Tanks	0.3	1.7	216.3	-	-	-	-	2.3	87.0
Crude Oil Tanks	0.2	0.9	1,719.3	64.0	-	-	-	41.6	240.7
Dehydrators	0.0	0.0	10.8	-	0.0	0.0	-	8.9	11.1
Drill Rigs	15.6	4.7	0.9	0.0	0.7	0.6	-	0.1	0.0
Fugitives	-	-	532.0	-	-	-	9.1	2.7	1,417.2
Gas-Actuated Pumps	-	-	189.4	-	-	-	2.3	0.8	512.3
Heaters	406.0	341.0	22.3	0.0	30.9	30.9	-	3.1	9.3
Hydraulic Fracturing	0.6	0.1	0.0	0.0	0.0	0.0	-	0.0	0.0

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Lateral/Gathering Line Compressors	372.3	534.5	10.6	0.1	4.0	4.0	-	5.2	103.4
Loading Emissions	-	-	6.9	-	-	-	0.0	0.1	0.2
Mud Degassing	-	-	43.2	-	-	-	0.6	0.2	104.5
Pneumatic Devices	-	-	2,894.0	-	-	-	24.9	10.8	10,660.2
Produced Water	-	-	49.0	-	-	-	0.8	0.2	99.9
Well Completions	0.1	0.6	20.7	1.1	-	-	-	0.2	45.4
Wellhead Compressor Engines	4,794.8	6,554.0	183.0	2.0	56.8	56.8	-	78.5	1,855.8
Permian Basin	166,428.8	226,582.7	386,201.5	8,625.6	3,437.3	3,431.6	3,288	6,910.9	626,541.9
Artificial Lift Engines	24,576.8	38,001.9	320.5	6.4	210.1	210.1	-	247.5	2,490.2
Blowdowns	107.8	569.7	27,390.3	-	-	-	-	61.6	78,473.1
Casinghead Gas Venting	-	-	-	-	-	-	-	-	-
Condensate Tanks	16.8	88.9	15,190.4	-	-	-	-	159.9	6,109.3
Crude Oil Tanks	107.4	567.8	180,759.1	7,904.5	-	-	-	4,425.8	25,338.2
Dehydrators	0.0	0.0	134.1	-	0.0	0.0	-	64.3	150.1
Drill Rigs	5,506.9	1,244.8	347.5	9.4	214.4	208.7	-	43.3	5.7
Fugitives	-	-	19,903.1	-	-	-	890.9	-	65,917.4
Gas-Actuated Pumps	-	-	6,409.2	-	-	-	246.1	-	20,833.8
Heaters	21,945.3	18,434.1	1,207.0	0.2	1,667.8	1,667.8	-	169.0	504.7
Hydraulic Fracturing	33.3	7.5	2.1	0.1	1.3	1.3	-	0.3	0.0
Lateral/Gathering Line Compressors	6,984.0	10,026.1	199.4	2.5	74.1	74.1	-	97.7	1,940.2
Loading Emissions	-	-	393.1	-	-	-	0.0	4.9	11.4
Mud Degassing	-	-	3,617.0	-	-	-	158.9	-	11,952.2
Pneumatic Devices	-	-	124,290.1	-	-	-	1,881	-	375,892.9

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Produced Water	-	-	3,279.4	-	-	-	110.3	-	10,508.6
Well Completions	53.4	282.1	71.1	661.2	-	-	-	30.5	38.9
Wellhead Compressor Engines	107,097.0	157,359.7	2,688.1	41.3	1,269.5	1,269.5	-	1,606.2	26,375.2
Salina Basin	82.2	85.6	610.3	0.0	4.1	4.1	0.8	2.2	994.6
Artificial Lift Engines	26.4	40.9	0.3	0.0	0.2	0.2	-	0.3	2.7
Blowdowns	-	-	0.2	-	-	-	-	0.0	3.5
Casinghead Gas Venting	0.0	0.0	11.2	-	-	-	-	0.0	21.3
Condensate Tanks	-	-	73.4	-	-	-	-	0.4	16.8
Crude Oil Tanks	-	-	47.6	-	-	-	-	1.1	6.7
Dehydrators	0.0	0.0	0.0	-	0.0	0.0	-	0.0	0.0
Drill Rigs	5.8	1.6	0.3	0.0	0.2	0.2	-	0.0	0.0
Fugitives	-	-	103.2	-	-	-	-	0.0	198.2
Gas-Actuated Pumps	-	-	16.0	-	-	-	0.8	0.0	49.7
Heaters	48.2	40.5	2.6	0.0	3.7	3.7	-	0.4	1.1
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-
Lateral/Gathering Line Compressors	0.4	0.5	0.0	0.0	0.0	0.0	-	0.0	0.1
Loading Emissions	-	-	0.6	-	-	-	0.0	0.0	0.0
Mud Degassing	-	-	15.3	-	-	-	-	-	29.2
Pneumatic Devices	-	-	332.1	-	-	-	-	0.0	641.8
Produced Water	-	-	0.7	-	-	-	-	-	10.2
Well Completions	-	-	6.8	-	-	-	-	-	12.9
Wellhead Compressor Engines	1.5	2.2	0.0	0.0	0.0	0.0	-	0.0	0.3
Sedgwick Basin	11,948.0	17,337.3	25,363.9	3.3	160.8	160.7	0.0	321.0	41,127.4
Artificial Lift Engines	5,100.9	7,887.3	66.5	1.3	43.6	43.6	-	51.4	516.8

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Blowdowns	-	-	26.3	-	-	-	-	0.1	69.8
Casinghead Gas Venting	-	-	19.6	-	-	-	-	0.1	50.5
Condensate Tanks	-	-	10,583.9	-	-	-	-	50.9	2,425.4
Crude Oil Tanks	-	-	297.2	-	-	-	-	7.2	41.6
Dehydrators	0.0	0.0	124.0	-	0.0	0.0	-	101.7	127.8
Drill Rigs	96.6	26.0	5.3	0.2	4.0	3.9	-	0.7	0.1
Fugitives	-	-	1,666.6	-	-	-	-	4.0	4,349.2
Gas-Actuated Pumps	-	-	604.2	-	-	-	-	1.4	1,587.1
Heaters	798.1	670.4	43.9	-	60.7	60.7	-	6.1	18.4
Hydraulic Fracturing	-	-	-	-	-	-	-	-	-
Lateral/Gathering Line Compressors	1,199.8	1,663.7	42.8	0.4	11.0	11.0	-	15.7	417.7
Loading Emissions	-	-	110.3	-	-	-	0.0	1.4	0.9
Mud Degassing	-	-	170.6	-	-	-	-	0.4	351.1
Pneumatic Devices	-	-	11,301.1	-	-	-	-	26.7	29,756.3
Produced Water	-	-	-	-	-	-	-	-	-
Well Completions	-	-	202.8	-	-	-	-	0.5	533.0
Wellhead Compressor Engines	4,752.5	7,089.8	98.7	1.4	41.6	41.6	-	52.8	881.9
Southern Oklahoma	7,491.5	9,423.2	30,292.2	26.7	194.7	194.6	16.7	377.0	56,053.5
Artificial Lift Engines	3,380.2	5,226.6	44.1	0.9	28.9	28.9	-	34.0	342.5
Blowdowns	-	-	1,906.1	0.5	-	-	-	3.3	10,495.8
Casinghead Gas Venting	-	-	287.1	0.3	-	-	-	-	325.3
Condensate Tanks	22.9	120.9	1,092.9	-	-	-	-	26.5	1,047.2
Crude Oil Tanks	0.0	0.1	6,873.3	17.9	-	-	-	209.9	594.5
Dehydrators	0.0	0.0	22.0	-	0.0	0.0	-	18.0	22.6

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Drill Rigs	75.8	17.9	4.7	0.1	3.0	2.9	-	0.6	0.1
Fugitives	-	-	3,056.3	-	-	-	2.8	0.6	5,103.8
Gas-Actuated Pumps	-	-	1,298.4	-	-	-	1.3	0.1	1,852.4
Heaters	1,635.1	1,373.5	89.9	0.0	124.3	124.3	-	12.6	37.6
Hydraulic Fracturing	14.7	3.3	0.9	0.0	0.6	0.6	-	0.1	0.0
Lateral/Gathering Line Compressors	652.6	759.0	40.2	0.4	10.7	10.7	-	15.6	431.2
Loading Emissions	-	-	110.3	-	-	-	0.0	0.9	7.3
Mud Degassing	-	-	159.1	-	-	-	0.2	0.0	205.5
Pneumatic Devices	-	-	15,046.4	-	-	-	12.4	6.8	34,160.3
Produced Water	-	-	-	-	-	-	-	-	-
Well Completions	11.7	62.1	143.2	5.5	-	-	-	6.7	172.7
Wellhead Compressor Engines	1,698.5	1,859.7	117.3	1.1	27.2	27.2	-	41.2	1,254.6
Western Gulf	142,581.7	187,678.0	433,119.4	8,495.6	2,425.3	2,419.9	1,010	6,969.1	566,775.2
Artificial Lift Engines	7,071.5	10,934.3	92.2	1.8	60.5	60.5	-	71.2	716.5
Blowdowns	-	-	12,719.8	1.0	-	-	-	33.6	62,538.4
Casinghead Gas Venting	0.4	2.3	5,568.6	5,674.2	-	-	-	26.5	7,785.8
Condensate Tanks	355.0	1,876.6	232,906.5	-	-	-	-	2,506.4	93,676.2
Crude Oil Tanks	6.7	35.2	69,960.2	2,604.2	-	-	-	1,694.1	9,793.1
Dehydrators	0.0	0.0	104.5	-	0.0	0.0	-	114.0	119.2
Drill Rigs	4,611.3	1,163.1	274.8	9.1	185.3	180.1	-	34.0	4.4
Fugitives	-	-	13,142.9	-	-	-	228.5	67.0	34,670.8
Gas-Actuated Pumps	-	-	4,658.8	-	-	-	58.6	20.4	12,461.9
Heaters	9,973.7	8,377.9	548.6	0.0	758.0	758.0	-	76.8	229.4
Hydraulic Fracturing	163.4	36.9	10.3	0.3	6.4	6.2	-	1.3	0.2

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Lateral/Gathering Line Compressors	8,920.8	12,806.4	254.7	3.2	94.7	94.7	-	124.8	2,478.2
Loading Emissions	-	-	4,084.2	-	-	-	0.0	45.7	122.0
Mud Degassing	-	-	3,579.7	-	-	-	44.9	14.8	9,296.2
Pneumatic Devices	-	-	70,510.7	-	-	-	622.1	264.0	257,480.2
Produced Water	-	-	7,513.8	-	-	-	55.9	26.2	25,744.1
Well Completions	16.6	87.6	2,934.5	154.8	-	-	-	23.8	6,517.7
Wellhead Compressor Engines	111,462.4	152,357.7	4,254.4	46.9	1,320.5	1,320.5	-	1,824.6	43,141.0
Grand Total (rounded to the nearest whole number)	836,191	1,092,020	1,616,981	21,110	17,406	17,374	8,002	28,891	3,708,820

Emissions for the regional portion of each basin within each CenSARA State are shown in Table 7-2.

Table 7-2. Emissions Inventory for 2011 oil and gas sources in CenSARA States.

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
AR	9,048.5	6,482.1	9,227.7	169.5	289.6	286.4	204.8	231.4	136,216.5
Arkoma Basin	7,682.3	5,093.8	5,593.4	7.1	230.8	227.9	0.3	129.3	130,901.3
Illinois Basin	15.3	13.5	15.6	0.0	0.4	0.4	0.0	0.3	372.7
Louisiana-Mississippi Salt Basins	1,350.9	1,374.7	3,618.6	162.5	58.4	58.1	204.6	101.8	4,942.5
Ozark Uplift	-	-	-	-	-	-	-	-	-
KS	79,531.7	104,801.3	208,158.0	145.5	2,172.8	2,172.1	354.9	2,128.9	548,165.2
Anadarko Basin	31,393.4	39,462.1	99,226.2	23.7	1,153.5	1,153.4	18.7	1,109.0	261,528.0
Cambridge Arch-Central Kansas Uplift	8,814.5	11,000.5	31,512.0	2.2	274.6	274.3	0.0	164.7	79,331.9
Cherokee Platform	19,295.5	25,686.3	36,924.6	114.4	415.2	415.1	314.0	424.5	131,460.5

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Forest City Basin	4,313.7	6,048.6	7,891.5	1.0	88.5	88.4	11.4	57.1	18,637.9
Nemaha Uplift	3,684.5	5,180.9	6,704.2	0.9	76.1	76.0	10.0	50.8	15,111.9
Salina Basin	82.2	85.6	535.6	0.0	4.1	4.1	0.8	1.8	967.6
Sedgwick Basin	11,948.0	17,337.3	25,363.9	3.3	160.8	160.7	0.0	321.0	41,127.4
LA	42,316.2	52,600.5	103,011.3	3,172.4	1,092.8	1,089.5	1,324	2,643.2	205,568.8
Louisiana-Mississippi Salt Basins	38,481.1	47,681.0	36,722.2	296.2	995.5	992.5	1,199	1,624.4	153,658.4
Western Gulf	3,835.1	4,919.5	66,289.1	2,876.2	97.3	97.1	124.8	1,018.9	51,910.4
MO	16.7	23.5	57.4	1.6	0.4	0.4	0.1	0.8	73.3
Cherokee Platform	2.5	3.4	18.9	1.6	0.1	0.1	0.1	0.4	11.5
Forest City Basin	14.2	20.1	38.6	0.0	0.3	0.3	0.0	0.4	61.9
Illinois Basin	-	-	-	-	-	-	-	-	-
Ozark Uplift	-	-	-	-	-	-	-	-	-
NE	2,089.7	2,952.8	16,305.9	0.6	29.4	29.4	0.2	99.0	19,418.6
Cambridge Arch-Central Kansas Uplift	525.5	728.3	8,281.7	0.2	8.2	8.2	0.0	45.1	7,092.5
Denver Basin	1,547.2	2,203.1	7,693.4	0.4	20.8	20.8	0.2	52.4	11,984.2
Forest City Basin	17.0	21.4	256.1	0.0	0.4	0.4	0.0	1.1	315.0
Nemaha Uplift	-	-	-	-	-	-	-	-	-
Salina Basin	-	-	74.7	-	-	-	-	0.4	27.0
OK	71,339.9	88,497.6	198,543.7	533.2	2,069.6	2,067.4	354.3	2,731.2	617,260.1
Anadarko Basin	33,265.4	40,916.0	103,940.2	30.4	1,213.8	1,212.1	19.5	1,515.5	259,066.3
Arkoma Basin	7,933.2	7,368.0	10,680.2	10.2	197.8	197.4	3.2	211.5	163,325.1
Bend Arch-Fort Worth Basin	39.8	45.2	240.5	9.7	1.7	1.7	3.1	3.1	298.8
Cherokee Platform	17,018.4	22,800.2	37,007.3	451.4	376.1	376.0	306.0	477.1	108,565.1
Nemaha Uplift	5,396.9	7,686.1	15,997.6	1.4	82.0	82.0	4.8	141.5	28,671.5
Palo Duro Basin	194.5	258.8	385.7	3.4	3.6	3.6	0.9	5.6	1,279.8

Basin/Source Category	2011 Emissions (Tons per year)								
	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	H_2S	HAPs	CH_4
Southern Oklahoma	7,491.5	9,423.2	30,292.2	26.7	194.7	194.6	16.7	377.0	56,053.5
TX	631,848	836,662	1,081,677	17,087	11,751	11,729	5,764	21,056	2,182,117
Anadarko Basin	44,293.0	53,266.4	69,899.1	35.0	1,400.6	1,396.0	10.7	1,463.1	187,888.6
Bend Arch-Fort Worth Basin	143,992	189,165.7	147,405.8	1,657.6	2,467.2	2,463.1	1,102	3,096.3	458,243.6
East Texas Basin	128,840	171,678.3	100,631.5	944.4	1,975.3	1,972.9	439.8	3,417.4	364,708.0
Marathon Thrust Belt	3,863.2	5,585.2	4,525.2	1.6	51.9	51.9	0.5	64.8	13,172.8
Palo Duro Basin	5,684.7	7,626.1	6,184.3	203.4	91.2	91.2	36.9	154.0	16,698.2
Permian Basin	166,428	226,582.7	386,201.5	8,625.6	3,437.3	3,431.6	3,288	6,910.9	626,541.9
Western Gulf	138,746	182,758.4	366,830.3	5,619.4	2,327.9	2,322.9	885.2	5,950.2	514,864.8
Total CenSARA domain (rounded to the nearest whole number)	836,191	1,092,020	1,616,981	21,110	17,406	17,374	8,002	28,891	3,708,820

7.2 Discussion

7.2.1 Major oil and gas area sources

Oil and gas activities in the upstream sector often involve the use of internal combustion engines and external combustion equipment during the drilling and production phases such as compressor engines, drilling rigs, artificial lift engines, heaters, etc. Hence, several major sources of NOx emissions can be found in this sector. The CenSARA 2011 inventories suggest that in almost every basin, wellhead compressor engines are the largest source of NOx emissions across the CenSARA domain, representing on average at least 50% of the total basin-level NOx emissions in some of the basins such as Permian, Western Gulf, Anadarko, Bend Arch Fort Worth and East Texas. NOx sources are shown in Figure 7-1 for each basin.

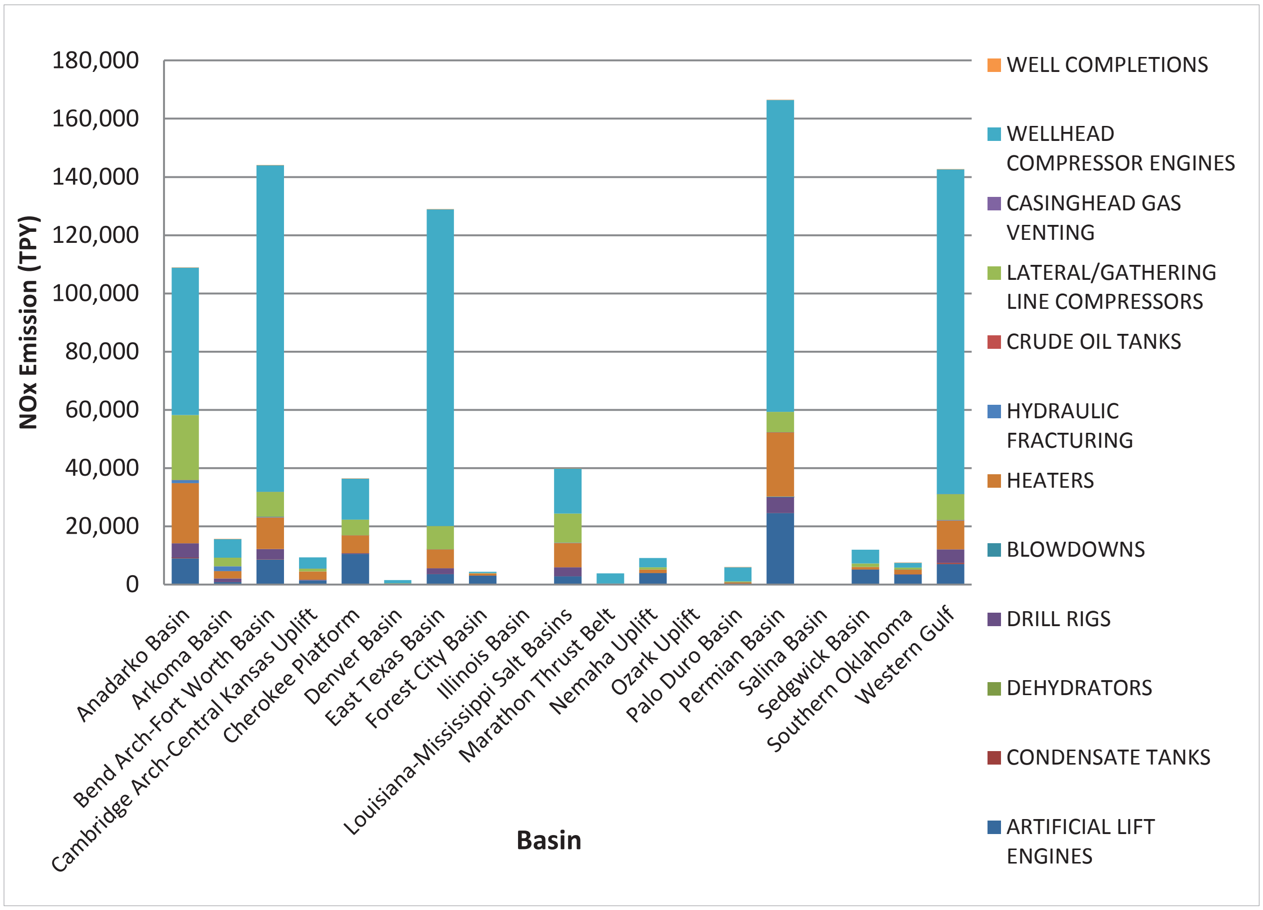

Figure 7-1. NOx emissions by source category (in tons per year).

Lateral compressors are another major source of NOx in the CenSARA region. NOx compressor emissions are generally large in older gas producing basins that have lower wellhead pressures and thus higher compression requirements. The compression requirements of a basin are reflected in the usage fraction of wellhead compressors and lateral compressors which varies significantly by basin. For wellhead compression, this can range from 8 percent of wells requiring wellhead compressors in the Louisiana Mississippi Salt Flats to 99 percent of wells

requiring wellhead compression in some counties in Texas. Usage of lateral compressors is less common with usage fractions ranging from two percent in the Salt Flats to 8 percent in Anadarko. Heaters also appear to be a major source of NOx emissions in the region, especially in the oil producing basins where this equipment is more commonly used. Vented gas sources in Figure 7-1 can have associated NOx emissions when flaring or other combustion-device controls are applied. In the current inventories, flaring emissions are embedded in many venting source categories such as well completions, condensate tanks, crude oil tanks, blowdowns and dehydrators.

VOCs emissions from venting and fugitives are commonly emitted in upstream oil and gas operations. Other sources of VOCs include incomplete fuel combustion in equipment such as engines and flares, but emissions from these are very minimal compared to direct sources. The distribution of VOCs emissions by source category within each basin is shown in Figure 7-2.

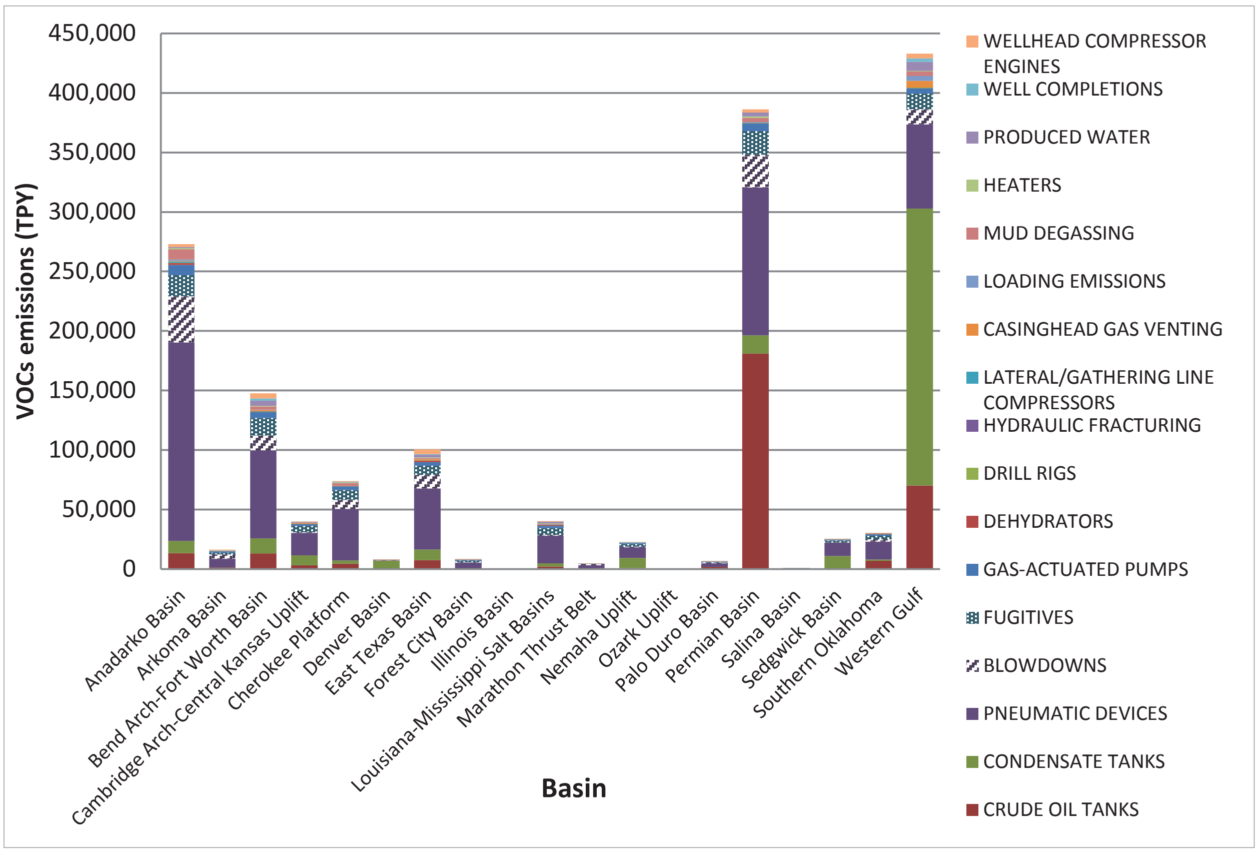

Figure 7-2. VOCs emissions by source category (in tons per year).

Major sources of VOC emissions vary greatly by basin. Results suggest that the distribution of VOC emissions amongst area sources is highly dependent on regional factors of the oil and gas producing regions that describe their production and operations, that is, the concentration of VOCs in the produced gas, the amount of condensate production, the level of crude oil production, regional controls for venting sources, etc. One source that appears to be

consistently significant for VOCs among all basins is pneumatic devices. The use of no-bleed/low-bleed devices in each basin plays an important role in the level of VOC emissions from this source. This source is also driven by the well counts of each basin and the amount of VOCs in the gas. For example, the Anadarko, Western Gulf, Permian and Bend Arch-Fort Worth Basins have the largest numbers of active wells within the CenSARA domain, and thus show a large portion of basin-wide VOC emissions coming from pneumatic devices. Another important source of VOCs is related to tank losses for the storage of condensate and crude oil. This is particularly relevant in basins with significant condensate and crude oil production such as Permian, Anadarko and Western Gulf. Basin-wide venting emissions from sources such as these, along with well completions, blowdowns and dehydrators can be significantly reduced by regional practices on the use of controls involving capture and flaring. Some basins were found through the surveys to commonly control tank emissions by flare, such as Anadarko and Arkoma. Similarly, high concentrations of non-methane hydrocarbons in the produced gas from a basin can generally have a large impact on the overall VOC emissions of that region; thus, basins like Arkoma and Louisiana Mississippi Salt Flats which produce large amounts of dry gas (shale gas from the Fayetteville Shale and Haynesville Shale) have a limited amount of VOCs emissions due to the low concentration of these pollutants in the gas.

Methane is a gas species commonly emitted by area sources in natural gas production facilities since it makes up the bulk of the mass of the produced gas. Similar to VOCs, the majority of methane emissions are originated by direct sources such as vented gas from blowdowns, well completions, pneumatic devices, gas actuated pumps, and fugitives. Unless capturing or flaring methods are used, these direct sources can release a significant amount of methane. Figure 7-3 shows all sources of methane for each of the CenSARA basins. Results suggest that pneumatic devices are commonly the largest source of methane emissions across all basins. This is comparable to VOC emissions, as pneumatic devices bleed the produced gas which contains both methane and VOC pollutants. Another major source of methane appears to be blowdowns and fugitives which are also direct sources. Blowdown emissions are driven by gas well counts and basin specific vent rates, hence basins that have a substantial number of active gas wells such as Anadarko, Arkoma and Western Gulf, among others, show large methane emissions for this source.

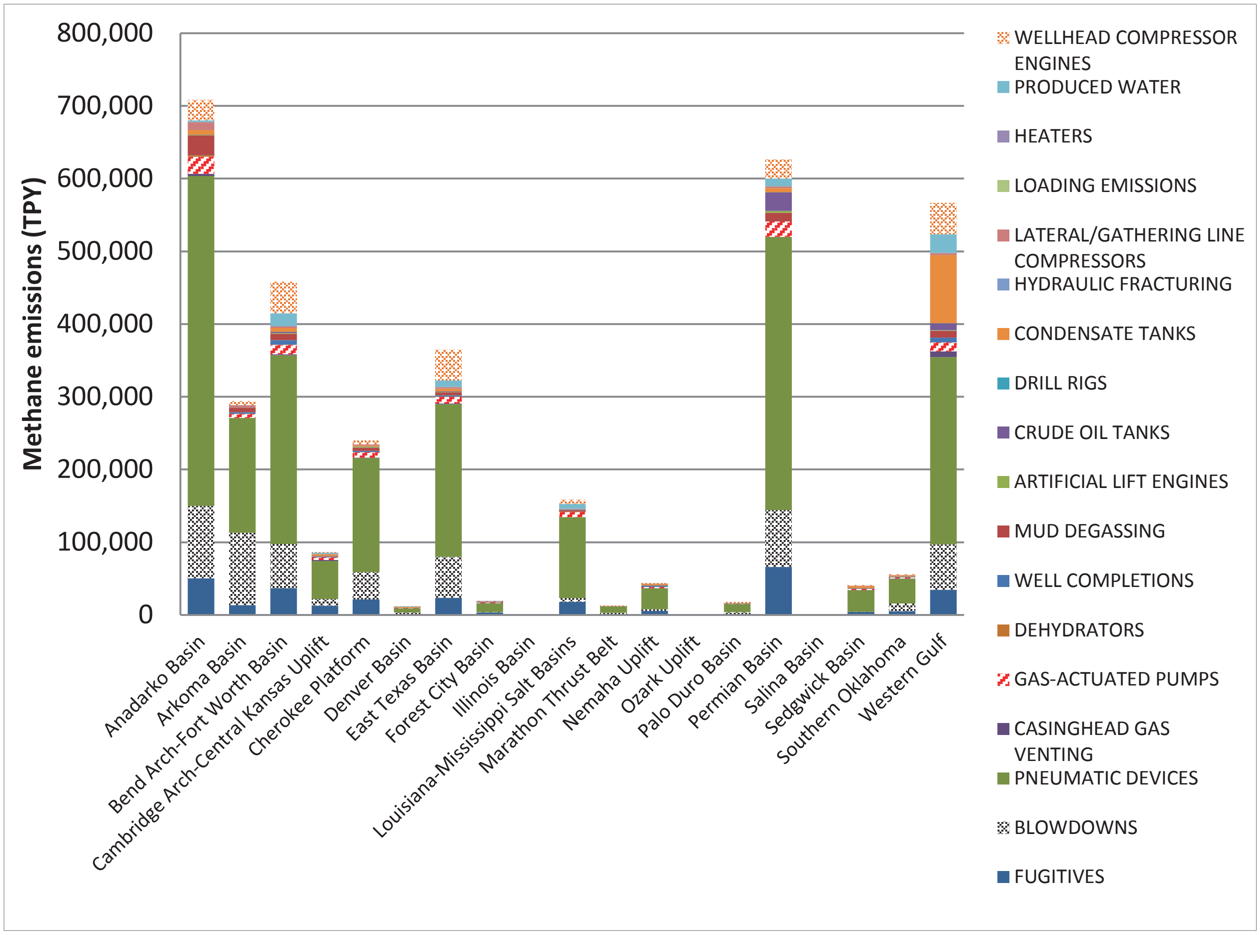

Figure 7-3. Methane emissions by source category (in tons per year).

7.2.2 Data Gap Findings

A series of data gaps have been identified during the development of this regional inventory which affect the quality of emissions estimates. There is an ongoing need for additional information at the basin level on equipment and activities related to oil and gas area emissions sources to address data gaps. Data gaps include information on equipment usage and size, local gas compositions, usage of control methods, venting rates for particular sources, etc.

Given the scope and resources of this Project, not all basins in the CenSARA region were part of the industry survey outreach and thus, those basins for which local data could not be gathered through industry surveys or any other means like permit data, were based on national default literature values or regional averages of other basins (as delineated in Section 5.3.2). Similarly, a defined set of source categories were included in the surveys, those considered significant sources of air pollutants or "high-tier", thus availability of local data for the remaining "low-tier" source categories was limited. Table 7-3 provides an assessment on the quality of the input data used to estimate emissions for key sources identified in this inventory. This evaluation is qualitative and based on the level of representativeness that each data input is

believed to have for the basin it was applied to. The following classifications have been made to evaluate input data:

- High: Data based on a significant number of useful survey entries for a particular source category and data field; or data obtained from the compilation of local data through state air agencies' determinations.
- Medium: Data based on a limited number of survey entries for a particular source category and data field; or data obtained through the compilation and averaging of data from minor source permit applications. Permit applications were available for minor sources located at specific basins, and thus data from this information source was regionally representative, although it may present the caveats of permit data (conservative assumptions, year of permit, etc.).
- Low: Data based on averages of all industry survey data available for a particular source category and data field regardless of the geographical specificity; or data based on default values derived from other regional or national emissions inventory studies.

The analysis in Table 7-3 includes each of the surveyed basins, as well as the non-surveyed basins which are divided in two distinctive groups: "other basins in Texas (except Permian and Marathon Thrust Belt)", and "non-surveyed basins outside of Texas". As explained in Section 5.3.2, input data was managed differently for basins in each of these two groups; for instance, basin-specific averaging rules (Table 5-5) were applied to data fields for non-surveyed basins outside of Texas. Nevertheless, input values for basins in this group were derived from regional averages and thus fall under the "low" quality input data classification. The Marathon Thrust Belt is a small basin bordering south of the Permian and it is assumed to have very similar operational characteristics to it, thus, MTB data is assumed to be equivalent to that of the Permian basin, which may qualify from high to low depending on the source of data for Permian. For "other basins in Texas", data sources varied on a case by case basis. Many source categories inventoried in this study have not yet been included in previous Texas inventories and thus averages of survey data were applied in these cases, while when regional data from other studies were available, these were used. Based on this, Texas' basins input data may be classified under the various designations shown above.

Table 7-3. Quality assessment of input data used to estimate emissions for each area source category and basin in CenSARA.

Source Category	Data field/Inputs	Anadarko Basin	Arkoma Basin	Cambridge Arch-Central Kansas Uplift	Permian Basin (and Marathon Thrust Belt)	Louisiana-Mississippi Salt Basins	Sedgwick Basin	Other basins in Texas (except Permian and MTB)	Non-surveyed basins outside of Texas
ARTIFICIAL LIFT ENGINES	Fraction of oil wells with artificial lift engines	high	low	high	low	medium	medium	low	low
ARTIFICIAL LIFT ENGINES	Rated Horsepower	high	low	high	low	medium	high	high	low
ARTIFICIAL LIFT ENGINES	Annual Activity (hours/yr)	high	medium	high	low	medium	high	high	low
ARTIFICIAL LIFT ENGINES	Load Factor	high	low	high	low	medium	high	high	low
ARTIFICIAL LIFT ENGINES	% of artificial lift engines that are electrified	medium	low	high	low	medium	medium	high	low
ARTIFICIAL LIFT ENGINES	Emissions Factors (g/hp-hr)	low	low	low	low	low	low	high	low
WELLHEAD COMPRESSORS	Fraction of wells with wellhead compressors	high	medium	low	medium	medium	low	low	low
WELLHEAD COMPRESSORS	Annual Activity (hr)	high	medium	low	low	medium	medium	high	low
WELLHEAD COMPRESSORS	Fraction Rich Burn (RB) versus Lean Burn (LB)	medium	medium	low	medium	low	low	high	low
WELLHEAD COMPRESSORS - LEAN	LB Rated Horsepower	high	medium	low	low	low	low	high	low
WELLHEAD COMPRESSORS - LEAN	LB Load Factor	low	medium	low	low	low	low	high	low
WELLHEAD COMPRESSORS - LEAN	% LB Engines Controlled	medium	medium	low	low	low	low	high	low
WELLHEAD COMPRESSORS - LEAN	CO Control Factor Cat. Oxidizer	low	low	low	low	low	low	high	low
WELLHEAD COMPRESSORS - LEAN	LB Emissions Factors (g/hp-hr)	low	low	low	low	low	low	high	low
WELLHEAD COMPRESSORS - RICH	RB Rated Horsepower	high	medium	low	low	medium	low	high	low
WELLHEAD COMPRESSORS - RICH	RB Load Factor	medium	medium	low	low	medium	low	high	low
WELLHEAD COMPRESSORS - RICH	% RB Engines Controlled	medium	medium	low	low	low	low	high	low
WELLHEAD COMPRESSORS - RICH	NOx, CO Control Factor NSCR	medium	medium	low	low	low	low	high	low
WELLHEAD COMPRESSORS - RICH	VOC Control Factor NSCR	medium	medium	low	low	low	low	high	low
WELLHEAD COMPRESSORS - RICH	RB Emissions Factors (g/hp-hr)	low	low	low	low	low	low	high	low

Source Category	Data field/Inputs	Anadarko Basin	Arkoma Basin	Cambridge Arch-Central Kansas Uplift	Permian Basin (and Marathon Thrust Belt)	Louisiana-Mississippi Salt Basins	Sedgwick Basin	Other basins in Texas (except Permian and MTB)	Non-surveyed basins outside of Texas
LATERAL/GATHERING COMPRESSORS	No. wells served by a single lateral compressor	medium	medium	medium	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS	Annual Activity (hr)	medium	medium	medium	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS	Fraction Rich Burn (RB) versus Lean Burn (LB)	medium	medium	low	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS - LEAN BURN	LB Rated Horsepower	medium	low	medium	low	low	low	low	low
LATERAL/GATHERING COMPRESSORS - LEAN BURN	LB Load Factor	medium	medium	medium	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS - LEAN BURN	% LB Engines Controlled	medium	medium	low	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS - LEAN BURN	CO Control Factor Cat. Oxidizer	low	low	low	low	low	low	low	low
LATERAL/GATHERING COMPRESSORS - LEAN BURN	LB Emissions Factors (g/hp-hr)	low	low	low	low	low	low	low	low
LATERAL/GATHERING COMPRESSORS - RICH BURN	RB Rated Horsepower	low	medium	medium	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS - RICH BURN	RB Load Factor	low	low	medium	low	low	low	low	low
LATERAL/GATHERING COMPRESSORS - RICH BURN	% RB Engines Controlled	medium	medium	low	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS - RICH BURN	NOx, CO Control Factor NSCR	medium	medium	low	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS - RICH BURN	VOC Control Factor NSCR	medium	medium	low	low	medium	low	low	low
LATERAL/GATHERING COMPRESSORS - RICH BURN	RB Emissions Factors (g/hp-hr)	low	low	low	low	low	low	low	low

Source Category	Data field/Inputs	Anadarko Basin	Arkoma Basin	Cambridge Arch-Central Kansas Uplift	Permian Basin (and Marathon Thrust Belt)	Louisiana-Mississippi Salt Basins	Sedgwick Basin	Other basins in Texas (except Permian and MTB)	Non-surveyed basins outside of Texas
DRILLING RIGS	Fraction of drill-rigs that are diesel-electric	medium	low	low	low	low	low	low	low
DRILLING RIGS	Individual data on engines for horizontal and vertical drilling	medium	medium	low	low	low	low	low	low
DRILLING RIGS	Number of engines per rig	high	high	medium	low	medium	low	low	low
DRILLING RIGS	Depth per spud (ft)	medium	medium	medium	low	medium	low	low	low
DRILLING RIGS	Rated Horsepower (hp) for each engine	high	high	medium	low	medium	low	low	low
DRILLING RIGS	Load Factors	medium	medium	medium	low	medium	low	low	low
DRILLING RIGS	Hours of use (hr/spud) per engine	medium	medium	medium	low	medium	low	low	low
DRILLING RIGS	Emissions Factors (g/hp-hr)	medium	medium	medium	medium	medium	medium	medium	medium
CONDENSATE TANKS	Fraction of Production to Tanks	low	low	low	low	low	low	low	low
CONDENSATE TANKS	Fraction of Tanks Flared	high	medium	low	low	medium	low	low	low
CONDENSATE TANKS	VOC Fraction of the flash gas	medium	medium	medium	low	medium	medium	low	low
CONDENSATE TANKS	Average losses per unit throughput (lb-VOC/bbl of condensate)	high	medium	medium	high	medium	medium	high	low
CONDENSATE TANKS	Condensate tank flash gas composition	medium	medium	medium	low	medium	medium	low	low
WELL COMPLETIONS	Volume of Gas Vented Per Completion (MCF/event) uncontrolled	medium	high	high	low	medium	low	low	low
WELL COMPLETIONS	Fraction of Completions with Flaring	medium	high	high	low	medium	low	low	low
WELL COMPLETIONS	Fraction of Completions with Green Completion	medium	high	high	low	medium	low	low	low
WELL COMPLETIONS	Flaring Control Efficiency (%)	low	high	high	low	low	low	low	low
WELL COMPLETIONS	Flaring Capture Efficiency (%)	low	high	high	low	low	low	low	low

Source Category	Data field/Inputs	Anadarko Basin	Arkoma Basin	Cambridge Arch-Central Kansas Uplift	Permian Basin (and Marathon Thrust Belt)	Louisiana-Mississippi Salt Basins	Sedgwick Basin	Other basins in Texas (except Permian and MTB)	Non-surveyed basins outside of Texas
WELL COMPLETIONS	Criteria pollutant and GHGs speciation of vented gas	high	high	high	medium	high	high	low	low
WELL COMPLETIONS	HAPS speciation of vented gas	medium	low	low	low	medium	low	low	low
WELL COMPLETIONS	Local Heating Value (BTU/SCF)	medium	high	high	low	medium	low	low	low
WELL COMPLETIONS	Molecular Weight of the Gas	medium	low	low	low	medium	low	low	low
HYDRAULIC FRACTURING	Rated Horsepower	low	medium	medium	low	low	low	low	low
HYDRAULIC FRACTURING	Load Factor	low	medium	low	low	low	low	low	low
HYDRAULIC FRACTURING	No. Stages per Well (stages/well)	low	medium	medium	low	low	low	low	low
HYDRAULIC FRACTURING	Duration per Stage (hr/stage)	low	medium	medium	low	low	low	low	low
HYDRAULIC FRACTURING	No. Engines Used per Fracing Event	low	medium	medium	low	low	low	low	low
HYDRAULIC FRACTURING	Total HP-HR per well	medium	medium	medium	low	low	low	low	low
BLOWDOWNS	Average Blowdown Frequency (events/well-year)	medium	medium	low	medium	medium	medium	low	low
BLOWDOWNS	Volume of Gas Vented Per Blowdown (MCF/event) uncontrolled	medium	medium	low	medium	medium	medium	low	low
BLOWDOWNS	Fraction of Blowdowns that are Controlled	medium	medium	low	medium	low	low	low	low
BLOWDOWNS	Control Method Efficiency (%)	low	low	low	low	low	low	low	low
BLOWDOWNS	Criteria pollutant and GHGs speciation of vented gas	high	high	high	medium	high	high	low	low
BLOWDOWNS	HAPS speciation of vented gas	medium	low	low	low	medium	low	low	low
CASING GAS	Venting Rate of Casing Gas per Unit of Oil Production (MCF/bbl)	medium	low	medium	low	low	medium	low	low
CASING GAS	Fraction of Vents Controlled by Flaring (Fflare)	low	low	medium	low	low	medium	low	low

Source Category	Data field/Inputs	Anadarko Basin	Arkoma Basin	Cambridge Arch-Central Kansas Uplift	Permian Basin (and Marathon Thrust Belt)	Louisiana-Mississippi Salt Basins	Sedgwick Basin	Other basins in Texas (except Permian and MTB)	Non-surveyed basins outside of Texas
CASING GAS	Flaring Control Efficiency (%)	low	low	low	low	low	low	low	low
CASING GAS	Flaring Capture Efficiency (%)	low	low	low	low	low	low	low	low
PNEUMATIC DEVICES	No. of Devices by Bleed Rate Classification	medium	medium	low	medium	medium	low	low	low
PNEUMATIC DEVICES	Bleed Rates (by device)	low	low	low	low	low	low	low	low
PNEUMATIC DEVICES	Criteria pollutant and GHGs speciation of vented gas	high	high	high	medium	high	high	low	low
PNEUMATIC DEVICES	HAPS speciation of vented gas	medium	low	low	low	medium	low	low	low
DEHYDRATORS	Fraction of Dehydrators with Flares	low	low	low	low	low	low	low	low
DEHYDRATORS	Still Vent VOC Emissions (lb-VOC/MMSCF)	medium	medium	medium	low	medium	medium	low	low
DEHYDRATORS	Heater MMBTU Rating (MMBTU/hr)	medium	medium	medium	low	low	low	low	low
DEHYDRATORS	Local Heating Value (BTU/SCF)	medium	medium	medium	low	medium	medium	low	low
DEHYDRATORS	Annual Heater Usage (hr)	medium	medium	medium	low	low	low	low	low
DEHYDRATORS	Dehydrator still vent gas speciation	low	low	low	low	low	low	low	low
DEHYDRATORS	Dehydrator reboiler emissions factors (lb/MMSCF)	low	low	low	low	low	low	low	low
CRUDE TANKS	Fraction of Production to Tanks	low	low	low	low	low	low	low	low
CRUDE TANKS	Fraction of Tanks Flared	medium	medium	medium	medium	medium	medium	low	low
CRUDE TANKS	Average Loss Emissions (lb-VOC/bbl)	medium	medium	medium	low	medium	medium	low	low
CRUDE TANKS	Local Heating Value (BTU/SCF)	medium	medium	low	low	medium	low	low	low
CRUDE TANKS	VOC fraction of the gas	medium	medium	low	low	medium	low	low	low
CRUDE TANKS	Molecular weight of the gas	medium	medium	low	low	medium	low	low	low
CRUDE TANKS	Oil tank losses gas analysis - Criteria Pollutants and GHGs	medium	medium	low	low	medium	low	low	low

Source Category	Data field/Inputs	Anadarko Basin	Arkoma Basin	Cambridge Arch-Central Kansas Uplift	Permian Basin (and Marathon Thrust Belt)	Louisiana-Mississippi Salt Basins	Sedgwick Basin	Other basins in Texas (except Permian and MTB)	Non-surveyed basins outside of Texas
CRUDE TANKS	Oil tank losses gas analysis - HAPs speciation	low	medium	low	low	medium	low	low	low
GAS-ACTUATED PUMPS	Kimray pumps venting rate per unit throughput (SCF-CH4/MMSCF gas)	low	low	low	low	low	low	low	low
GAS-ACTUATED PUMPS	Annual gas pumped per well (MMSCF/yr/well)	low	low	low	low	low	low	low	low
GAS-ACTUATED PUMPS	Chemical injection pump venting rate per pump (SCF-CH4/pump/day)	low	low	low	low	low	low	low	low
GAS-ACTUATED PUMPS	Average number of pumps per gas/oil well	low	low	low	low	low	low	low	low
GAS-ACTUATED PUMPS	Criteria pollutant and GHGs speciation of vented gas	high	high	high	medium	high	high	low	low
GAS-ACTUATED PUMPS	HAPS speciation of vented gas	medium	low	low	low	medium	low	low	low
FUGITIVES	No. of devices per typical well by device type and by service	medium	medium	medium	medium	medium	low	low	low
FUGITIVES	Pollutant to TOC fraction in leaked gas - criteria pollutants and GHGs	high	high	high	medium	high	high	low	low
FUGITIVES	Pollutant to TOC fraction in leaked gas - HAPs	medium	low	low	low	medium	low	low	low
FUGITIVES	Compressor seals leaking rate per engine (SCF-CH4/hr/compressor)	low	low	low	low	low	low	low	low
FUGITIVES	Fraction of wells serviced by wellhead compressors	high	medium	low	medium	medium	low	low	low
FUGITIVES	No. wells served by single lateral compressor [wells/compressor]	medium	medium	medium	low	medium	low	low	low
FUGITIVES	Annual Activity (hr)	low	low	low	low	low	low	low	low

Data fields with "low quality" designation would benefit from further research and collection of operator data. These fields are generally in source categories that, individually, are not the most significant area sources of key pollutants (VOC, NOx) but combined provide a significant emissions contribution to area source inventories. These data are also generally poorly characterized at the basin level in many oil and gas inventories, thus making it difficult to find regionally-representative data in the literature.

The quality of survey data was greatly affected by the level of response from operators. This is not only manifested through the number of operators that returned survey forms for each basin, but also by the actual number of survey data requests that were completed and proved useful towards deriving basin-wide input values. Some source categories received a larger number of responses than others, and this in addition varied by basin. Surveys for artificial lifts, drilling rigs, wellhead compressors, condensate tanks, and well completions yielded a good level of responsiveness in terms of participating companies and the amount of data provided. Other source categories did not have such a good response rate, such as dehydrators, lateral compressors and hydraulic fracturing pumps. Moreover, with some source categories surveys only partially completed, certain data fields within a source category yielded different levels of response and quality than other fields. This suggests the importance of survey outreach to be wide-ranging and supported by incentives for operators to fully collaborate in the provision of high quality and complete data.

Results suggest much of VOC and HAPs are generated by direct emissions from venting and fugitive sources, thus speciation of the local gas is essential to accurately characterize those emissions. This requires the compilation of local gas compositions at various points throughout natural gas and oil systems where these emissions occur; for example wellhead venting, piping and equipment emissions at the well-site, flashing and breathing emissions from oil/condensate tanks, and venting from gas dehydration. Gas analyses for vented gas from tanks and dehydrators are scarce and highly dependent on the basin where the gas is produced, thus it is imperative data is compiled by basin.

7.2.3 Future work opportunities

Many source categories would benefit from future work that aims at collecting updated regional field level data for certain sources within the CenSARA domain. Improvements are needed to better understand emissions from source categories associated with hydraulic fracturing such as well completions and frac pump engines as this region houses several key unconventional gas resources that require hydraulic fracturing. Available oil and gas emissions studies suggest that fugitive emissions are also not well characterized and regional and detailed emissions factors are yet to be developed for this source. Fugitive leaking rates used in this inventory and commonly used in other available inventories are based on EPA and GRI studies from the 1990's and may not be representative of conditions at many unconventional gas wells. Additional research is needed to improve these fugitive emissions factors. Produced water is perhaps one of the most poorly understood source categories. This includes holding ponds or tanks, evaporation ponds, and wastewater disposal facilities. Evolution of VOC emissions from produced water may be a significantly underestimated source category in the CenSARA domain,

especially in those basins housing shale gas plays where water consumption and production is high. In addition, water production statistics are not recorded consistently throughout all CenSARA states, thus restricting the ability of characterizing produced water emissions at the basin-level. Mud degassing is another poorly-understood VOC emissions source. The recent EPA Subpart W reporting requirements for GHG emissions from oil and gas systems could yield significant quantities of detailed data on equipment, processes and gas compositions that could be used to extract regionally specific data on this source (and many others) within the CenSARA domain.

A survey outreach is a recommended method to collecting data; however the efficacy of data collection will always be tied to the level of responsiveness and collaboration from oil and gas operators. Thus it is imperative that state agencies provide incentives and support to surveyed companies to encourage their participation. Certain key categories could benefit from additional information, particularly usage fractions of wellhead and lateral compressors within certain basins, manufacturer emissions factors for stationary compressors, and engine configurations and usage data for drilling rigs. For VOC emissions source categories, fugitive emissions represent one of the least studied emissions sources. It should be noted that significant quantity and detail of data on equipment, usage, configuration, and processes has now been gathered for the first time by EPA as part of Subpart W reporting of GHG emissions by oil and gas companies. To the extent that this data is made available to state agencies or the public for use in future emissions inventories, it may allow for checks on assumptions used in this inventory as well as revisions to lower quality input data.

Direct measurement of emissions rates and derivation of emissions factors from measured or monitored data is likely to produce accurate and regionally specific data but it is often not feasible to conduct this type of data collection from a large group of sources operating in a broad geographic region. When possible, direct measurement studies could be conducted to further characterize basin-wide average emission factors.

8.0 CONCLUSIONS

Oil and gas area source emissions inventories were developed in this work for oil and gas producing states within the CenSARA region. These inventories included a substantial level of detail in terms of geographical specificity (detail by basin, state and county), in the array of pollutants included (16 total) and the number of source categories analyzed (18 area sources, 34 SCCs). The development of detailed emissions inventories by source category led to several key conclusions:

- NOx emissions are dominated by wellhead compressors, particularly for gas producing basins with a large number of active gas wells;
- Other significant sources of NOx include lateral compressors and heaters, followed by drilling rigs and artificial lift engines;
- Other NOx emissions sources (e.g. flaring of vented sources and hydraulic fracturing engines) do not appear to contribute significantly to NOx emissions across the CenSARA domain;
- Pneumatic devices are the most significant source of VOC and methane emissions in most basins. In basins where the production of condensate and crude oil is extraordinary (Permian and Western Gulf), VOC emissions are dominated by condensate tank and crude oil tank losses;
- The VOC fraction of the gas and the use of flaring controls appear to be key variables in determining total VOC emissions with a basin (Arkoma, for example, has low VOC emissions relative to its substantial gas production, due to the low VOC content of the gas and flaring controls on condensate tanks).
- Other significant VOC and methane emissions source categories include blowdowns, fugitive emissions and wellhead compressor engine exhaust gas, particularly from lean burn compressor engines.

A series of data gaps were identified during the development of this work that ultimately affect the quality of emissions estimates in the inventory. This is related to an ongoing need for additional information at the basin level for equipment and activities specific to that basin's oil and gas area emissions sources. Some of the surveyed basin response levels in this work were relatively thorough while others were incomplete or not surveyed at all. Many source categories would benefit from future work that aims at collecting additional regional or basin-level data within the CenSARA domain. Work is also needed to better characterize emissions from source categories not surveyed in this study including fugitives, mud degassing and produced water . Future efforts should target gathering basin specific data so that higher quality calculation inputs may be developed and applied in the Emissions Calculator Tool developed here, enabling an effective and more accurate estimation of future year inventories for the CenSARA domain.

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APPENDIX A

CenSARA States County List

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Appendix A: CenSARA States County List

This includes counties that have not yet been assigned to a Basin.

Table A-1. List of counties in each CenSARA State including Basin designation.

FIPS Code	State	County	Basin
05001	AR	Arkansas	Louisiana-Mississippi Salt Basins
05003	AR	Ashley	Louisiana-Mississippi Salt Basins
05005	AR	Baxter	Ozark Uplift
05007	AR	Benton	Ozark Uplift
05009	AR	Boone	Ozark Uplift
05011	AR	Bradley	Louisiana-Mississippi Salt Basins
05013	AR	Calhoun	Louisiana-Mississippi Salt Basins
05015	AR	Carroll	Ozark Uplift
05017	AR	Chicot	Louisiana-Mississippi Salt Basins
05019	AR	Clark	Louisiana-Mississippi Salt Basins
05021	AR	Clay	Illinois Basin
05023	AR	Cleburne	Arkoma Basin
05025	AR	Cleveland	Louisiana-Mississippi Salt Basins
05027	AR	Columbia	Louisiana-Mississippi Salt Basins
05029	AR	Conway	Arkoma Basin
05031	AR	Craighead	Illinois Basin
05033	AR	Crawford	Arkoma Basin
05035	AR	Crittenden	Illinois Basin
05037	AR	Cross	Illinois Basin
05039	AR	Dallas	Louisiana-Mississippi Salt Basins
05041	AR	Desha	Louisiana-Mississippi Salt Basins
05043	AR	Drew	Louisiana-Mississippi Salt Basins
05045	AR	Faulkner	Arkoma Basin
05047	AR	Franklin	Arkoma Basin
05049	AR	Fulton	Ozark Uplift
05051	AR	Garland	Arkoma Basin
05053	AR	Grant	Louisiana-Mississippi Salt Basins
05055	AR	Greene	Illinois Basin
05057	AR	Hempstead	Louisiana-Mississippi Salt Basins
05059	AR	Hot Spring	Louisiana-Mississippi Salt Basins
05061	AR	Howard	Louisiana-Mississippi Salt Basins
05063	AR	Independence	Arkoma Basin
05065	AR	Izard	Ozark Uplift
05067	AR	Jackson	Illinois Basin
05069	AR	Jefferson	Louisiana-Mississippi Salt Basins

FIPS Code	State	County	Basin
05071	AR	Johnson	Arkoma Basin
05073	AR	Lafayette	Louisiana-Mississippi Salt Basins
05075	AR	Lawrence	Ozark Uplift
05077	AR	Lee	Illinois Basin
05079	AR	Lincoln	Louisiana-Mississippi Salt Basins
05081	AR	Little River	Louisiana-Mississippi Salt Basins
05083	AR	Logan	Arkoma Basin
05085	AR	Lonoke	Arkoma Basin
05087	AR	Madison	Arkoma Basin
05089	AR	Marion	Ozark Uplift
05091	AR	Miller	Louisiana-Mississippi Salt Basins
05093	AR	Mississippi	Illinois Basin
05095	AR	Monroe	Illinois Basin
05097	AR	Montgomery	Arkoma Basin
05099	AR	Nevada	Louisiana-Mississippi Salt Basins
05101	AR	Newton	Arkoma Basin
05103	AR	Ouachita	Louisiana-Mississippi Salt Basins
05105	AR	Perry	Arkoma Basin
05107	AR	Phillips	Illinois Basin
05109	AR	Pike	Louisiana-Mississippi Salt Basins
05111	AR	Poinsett	Illinois Basin
05113	AR	Polk	Arkoma Basin
05115	AR	Pope	Arkoma Basin
05117	AR	Prairie	Arkoma Basin
05119	AR	Pulaski	Arkoma Basin
05121	AR	Randolph	Ozark Uplift
05123	AR	St. Francis	Illinois Basin
05125	AR	Saline	Arkoma Basin
05127	AR	Scott	Arkoma Basin
05129	AR	Searcy	Arkoma Basin
05131	AR	Sebastian	Arkoma Basin
05133	AR	Sevier	Louisiana-Mississippi Salt Basins
05135	AR	Sharp	Ozark Uplift
05137	AR	Stone	Arkoma Basin
05139	AR	Union	Louisiana-Mississippi Salt Basins
05141	AR	Van Buren	Arkoma Basin
05143	AR	Washington	Arkoma Basin
05145	AR	White	Arkoma Basin
05147	AR	Woodruff	Illinois Basin
05149	AR	Yell	Arkoma Basin

FIPS Code	State	County	Basin
20001	KS	Allen	Cherokee Platform
20003	KS	Anderson	Forest City Basin
20005	KS	Atchison	Forest City Basin
20007	KS	Barber	Sedgwick Basin
20009	KS	Barton	Cambridge Arch-Central Kansas Uplift
20011	KS	Bourbon	Cherokee Platform
20013	KS	Brown	Forest City Basin
20015	KS	Butler	Nemaha Uplift
20017	KS	Chase	Nemaha Uplift
20019	KS	Chautauqua	Cherokee Platform
20021	KS	Cherokee	Cherokee Platform
20023	KS	Cheyenne	Cambridge Arch-Central Kansas Uplift
20025	KS	Clark	Anadarko Basin
20027	KS	Clay	Salina Basin
20029	KS	Cloud	Salina Basin
20031	KS	Coffey	Forest City Basin
20033	KS	Comanche	Anadarko Basin
20035	KS	Cowley	Nemaha Uplift
20037	KS	Crawford	Cherokee Platform
20039	KS	Decatur	Cambridge Arch-Central Kansas Uplift
20041	KS	Dickinson	Salina Basin
20043	KS	Doniphan	Forest City Basin
20045	KS	Douglas	Forest City Basin
20047	KS	Edwards	Anadarko Basin
20049	KS	Elk	Cherokee Platform
20051	KS	Ellis	Cambridge Arch-Central Kansas Uplift
20053	KS	Ellsworth	Cambridge Arch-Central Kansas Uplift
20055	KS	Finney	Anadarko Basin
20057	KS	Ford	Anadarko Basin
20059	KS	Franklin	Forest City Basin
20061	KS	Geary	Nemaha Uplift
20063	KS	Gove	Anadarko Basin
20065	KS	Graham	Cambridge Arch-Central Kansas Uplift
20067	KS	Grant	Anadarko Basin
20069	KS	Gray	Anadarko Basin
20071	KS	Greeley	Anadarko Basin
20073	KS	Greenwood	Cherokee Platform
20075	KS	Hamilton	Anadarko Basin
20077	KS	Harper	Sedgwick Basin
20079	KS	Harvey	Sedgwick Basin

FIPS Code	State	County	Basin
20081	KS	Haskell	Anadarko Basin
20083	KS	Hodgeman	Anadarko Basin
20085	KS	Jackson	Forest City Basin
20087	KS	Jefferson	Forest City Basin
20089	KS	Jewell	Salina Basin
20091	KS	Johnson	Forest City Basin
20093	KS	Kearny	Anadarko Basin
20095	KS	Kingman	Sedgwick Basin
20097	KS	Kiowa	Anadarko Basin
20099	KS	Labette	Cherokee Platform
20101	KS	Lane	Anadarko Basin
20103	KS	Leavenworth	Forest City Basin
20105	KS	Lincoln	Salina Basin
20107	KS	Linn	Forest City Basin
20109	KS	Logan	Anadarko Basin
20111	KS	Lyon	Forest City Basin
20113	KS	McPherson	Sedgwick Basin
20115	KS	Marion	Sedgwick Basin
20117	KS	Marshall	Nemaha Uplift
20119	KS	Meade	Anadarko Basin
20121	KS	Miami	Forest City Basin
20123	KS	Mitchell	Salina Basin
20125	KS	Montgomery	Cherokee Platform
20127	KS	Morris	Nemaha Uplift
20129	KS	Morton	Anadarko Basin
20131	KS	Nemaha	Nemaha Uplift
20133	KS	Neosho	Cherokee Platform
20135	KS	Ness	Anadarko Basin
20137	KS	Norton	Cambridge Arch-Central Kansas Uplift
20139	KS	Osage	Forest City Basin
20141	KS	Osborne	Salina Basin
20143	KS	Ottawa	Salina Basin
20145	KS	Pawnee	Cambridge Arch-Central Kansas Uplift
20147	KS	Phillips	Cambridge Arch-Central Kansas Uplift
20149	KS	Pottawatomie	Nemaha Uplift
20151	KS	Pratt	Cambridge Arch-Central Kansas Uplift
20153	KS	Rawlins	Cambridge Arch-Central Kansas Uplift
20155	KS	Reno	Sedgwick Basin
20157	KS	Republic	Salina Basin
20159	KS	Rice	Cambridge Arch-Central Kansas Uplift

FIPS Code	State	County	Basin
20161	KS	Riley	Nemaha Uplift
20163	KS	Rooks	Cambridge Arch-Central Kansas Uplift
20165	KS	Rush	Cambridge Arch-Central Kansas Uplift
20167	KS	Russell	Cambridge Arch-Central Kansas Uplift
20169	KS	Saline	Salina Basin
20171	KS	Scott	Anadarko Basin
20173	KS	Sedgwick	Sedgwick Basin
20175	KS	Seward	Anadarko Basin
20177	KS	Shawnee	Forest City Basin
20179	KS	Sheridan	Cambridge Arch-Central Kansas Uplift
20181	KS	Sherman	Cambridge Arch-Central Kansas Uplift
20183	KS	Smith	Salina Basin
20185	KS	Stafford	Cambridge Arch-Central Kansas Uplift
20187	KS	Stanton	Anadarko Basin
20189	KS	Stevens	Anadarko Basin
20191	KS	Sumner	Sedgwick Basin
20193	KS	Thomas	Cambridge Arch-Central Kansas Uplift
20195	KS	Trego	Cambridge Arch-Central Kansas Uplift
20197	KS	Wabaunsee	Nemaha Uplift
20199	KS	Wallace	Anadarko Basin
20201	KS	Washington	Salina Basin
20203	KS	Wichita	Anadarko Basin
20205	KS	Wilson	Cherokee Platform
20207	KS	Woodson	Cherokee Platform
20209	KS	Wyandotte	Forest City Basin
22001	LA	Acadia	Western Gulf
22003	LA	Allen	Western Gulf
22005	LA	Ascension	Western Gulf
22007	LA	Assumption	Western Gulf
22009	LA	Avoyelles	Western Gulf
22011	LA	Beauregard	Western Gulf
22013	LA	Bienville	Louisiana-Mississippi Salt Basins
22015	LA	Bossier	Louisiana-Mississippi Salt Basins
22017	LA	Caddo	Louisiana-Mississippi Salt Basins
22019	LA	Calcasieu	Western Gulf
22021	LA	Caldwell	Louisiana-Mississippi Salt Basins
22023	LA	Cameron	Western Gulf
22025	LA	Catahoula	Louisiana-Mississippi Salt Basins
22027	LA	Claiborne	Louisiana-Mississippi Salt Basins
22029	LA	Concordia	Louisiana-Mississippi Salt Basins

FIPS Code	State	County	Basin
22031	LA	De Soto	Louisiana-Mississippi Salt Basins
22033	LA	East Baton Rouge	Western Gulf
22035	LA	East Carroll	Louisiana-Mississippi Salt Basins
22037	LA	East Feliciana	Western Gulf
22039	LA	Evangeline	Western Gulf
22041	LA	Franklin	Louisiana-Mississippi Salt Basins
22043	LA	Grant	Louisiana-Mississippi Salt Basins
22045	LA	Iberia	Western Gulf
22047	LA	Iberville	Western Gulf
22049	LA	Jackson	Louisiana-Mississippi Salt Basins
22051	LA	Jefferson	Western Gulf
22053	LA	Jefferson Davis	Western Gulf
22055	LA	Lafayette	Western Gulf
22057	LA	Lafourche	Western Gulf
22059	LA	La Salle	Louisiana-Mississippi Salt Basins
22061	LA	Lincoln	Louisiana-Mississippi Salt Basins
22063	LA	Livingston	Western Gulf
22065	LA	Madison	Louisiana-Mississippi Salt Basins
22067	LA	Morehouse	Louisiana-Mississippi Salt Basins
22069	LA	Natchitoches	Louisiana-Mississippi Salt Basins
22071	LA	Orleans	Western Gulf
22073	LA	Ouachita	Louisiana-Mississippi Salt Basins
22075	LA	Plaquemines	Western Gulf
22077	LA	Pointe Coupee	Western Gulf
22079	LA	Rapides	Western Gulf
22081	LA	Red River	Louisiana-Mississippi Salt Basins
22083	LA	Richland	Louisiana-Mississippi Salt Basins
22085	LA	Sabine	Louisiana-Mississippi Salt Basins
22087	LA	St. Bernard	Western Gulf
22089	LA	St. Charles	Western Gulf
22091	LA	St. Helena	Western Gulf
22093	LA	St. James	Western Gulf
22095	LA	St. John the Baptist	Western Gulf
22097	LA	St. Landry	Western Gulf
22099	LA	St. Martin	Western Gulf
22101	LA	St. Mary	Western Gulf
22103	LA	St. Tammany	Western Gulf
22105	LA	Tangipahoa	Western Gulf
22107	LA	Tensas	Louisiana-Mississippi Salt Basins

FIPS Code	State	County	Basin
22109	LA	Terrebonne	Western Gulf
22111	LA	Union	Louisiana-Mississippi Salt Basins
22113	LA	Vermilion	Western Gulf
22115	LA	Vernon	Western Gulf
22117	LA	Washington	Western Gulf
22119	LA	Webster	Louisiana-Mississippi Salt Basins
22121	LA	West Baton Rouge	Western Gulf
22123	LA	West Carroll	Louisiana-Mississippi Salt Basins
22125	LA	West Feliciana	Western Gulf
22127	LA	Winn	Louisiana-Mississippi Salt Basins
29001	MO	Adair	Not Assigned
29003	MO	Andrew	Not Assigned
29005	MO	Atchison	Not Assigned
29007	MO	Audrain	Not Assigned
29009	MO	Barry	Not Assigned
29011	MO	Barton	Not Assigned
29013	MO	Bates	Not Assigned
29015	MO	Benton	Not Assigned
29017	MO	Bollinger	Not Assigned
29019	MO	Boone	Not Assigned
29021	MO	Buchanan	Not Assigned
29023	MO	Butler	Not Assigned
29025	MO	Caldwell	Not Assigned
29027	MO	Callaway	Not Assigned
29029	MO	Camden	Not Assigned
29031	MO	Cape Girardeau	Not Assigned
29033	MO	Carroll	Not Assigned
29035	MO	Carter	Not Assigned
29037	MO	Cass	Not Assigned
29039	MO	Cedar	Not Assigned
29041	MO	Chariton	Not Assigned
29043	MO	Christian	Not Assigned
29045	MO	Clark	Not Assigned
29047	MO	Clay	Not Assigned
29049	MO	Clinton	Not Assigned
29051	MO	Cole	Not Assigned
29053	MO	Cooper	Not Assigned
29055	MO	Crawford	Not Assigned
29057	MO	Dade	Not Assigned
29059	MO	Dallas	Not Assigned

FIPS Code	State	County	Basin
29061	MO	Daviess	Not Assigned
29063	MO	DeKalb	Not Assigned
29065	MO	Dent	Not Assigned
29067	MO	Douglas	Not Assigned
29069	MO	Dunklin	Illinois Basin
29071	MO	Franklin	Not Assigned
29073	MO	Gasconade	Not Assigned
29075	MO	Gentry	Not Assigned
29077	MO	Greene	Not Assigned
29079	MO	Grundy	Not Assigned
29081	MO	Harrison	Not Assigned
29083	MO	Henry	Not Assigned
29085	MO	Hickory	Not Assigned
29087	MO	Holt	Not Assigned
29089	MO	Howard	Not Assigned
29091	MO	Howell	Not Assigned
29093	MO	Iron	Not Assigned
29095	MO	Jackson	Not Assigned
29097	MO	Jasper	Not Assigned
29099	MO	Jefferson	Not Assigned
29101	MO	Johnson	Not Assigned
29103	MO	Knox	Not Assigned
29105	MO	Laclede	Not Assigned
29107	MO	Lafayette	Not Assigned
29109	MO	Lawrence	Not Assigned
29111	MO	Lewis	Not Assigned
29113	MO	Lincoln	Not Assigned
29115	MO	Linn	Not Assigned
29117	MO	Livingston	Not Assigned
29119	MO	McDonald	Not Assigned
29121	MO	Macon	Not Assigned
29123	MO	Madison	Not Assigned
29125	MO	Maries	Not Assigned
29127	MO	Marion	Not Assigned
29129	MO	Mercer	Not Assigned
29131	MO	Miller	Not Assigned
29133	MO	Mississippi	Not Assigned
29135	MO	Moniteau	Not Assigned
29137	MO	Monroe	Not Assigned
29139	MO	Montgomery	Not Assigned

FIPS Code	State	County	Basin
29141	MO	Morgan	Not Assigned
29143	MO	New Madrid	Not Assigned
29145	MO	Newton	Not Assigned
29147	MO	Nodaway	Not Assigned
29149	MO	Oregon	Not Assigned
29151	MO	Osage	Not Assigned
29153	MO	Ozark	Not Assigned
29155	MO	Pemiscot	Not Assigned
29157	MO	Perry	Not Assigned
29159	MO	Pettis	Not Assigned
29161	MO	Phelps	Not Assigned
29163	MO	Pike	Not Assigned
29165	MO	Platte	Not Assigned
29167	MO	Polk	Not Assigned
29169	MO	Pulaski	Not Assigned
29171	MO	Putnam	Not Assigned
29173	MO	Ralls	Not Assigned
29175	MO	Randolph	Not Assigned
29177	MO	Ray	Not Assigned
29179	MO	Reynolds	Not Assigned
29181	MO	Ripley	Not Assigned
29183	MO	St. Charles	Not Assigned
29185	MO	St. Clair	Not Assigned
29186	MO	Ste. Genevieve	Not Assigned
29187	MO	St. Francois	Not Assigned
29189	MO	St. Louis	Not Assigned
29193	MO	Ste. Genevieve	Not Assigned
29195	MO	Saline	Not Assigned
29197	MO	Schuyler	Not Assigned
29199	MO	Scotland	Not Assigned
29201	MO	Scott	Not Assigned
29203	MO	Shannon	Not Assigned
29205	MO	Shelby	Not Assigned
29207	MO	Stoddard	Not Assigned
29209	MO	Stone	Not Assigned
29211	MO	Sullivan	Not Assigned
29213	MO	Taney	Not Assigned
29215	MO	Texas	Not Assigned
29217	MO	Vernon	Not Assigned
29219	MO	Warren	Not Assigned

FIPS Code	State	County	Basin
29221	MO	Washington	Not Assigned
29223	MO	Wayne	Not Assigned
29225	MO	Webster	Not Assigned
29227	MO	Worth	Not Assigned
29229	MO	Wright	Not Assigned
29510	MO	St. Louis city	Not Assigned
31001	NE	Adams	Salina Basin
31003	NE	Antelope	Salina Basin
31005	NE	Arthur	Cambridge Arch-Central Kansas Uplift
31007	NE	Banner	Denver Basin
31009	NE	Blaine	Salina Basin
31011	NE	Boone	Salina Basin
31013	NE	Box Butte	Denver Basin
31015	NE	Boyd	Salina Basin
31017	NE	Brown	Salina Basin
31019	NE	Buffalo	Salina Basin
31021	NE	Burt	Salina Basin
31023	NE	Butler	Salina Basin
31025	NE	Cass	Nemaha Uplift
31027	NE	Cedar	Salina Basin
31029	NE	Chase	Cambridge Arch-Central Kansas Uplift
31031	NE	Cherry	Cambridge Arch-Central Kansas Uplift
31033	NE	Cheyenne	Denver Basin
31035	NE	Clay	Salina Basin
31037	NE	Colfax	Salina Basin
31039	NE	Cuming	Salina Basin
31041	NE	Custer	Salina Basin
31043	NE	Dakota	Salina Basin
31045	NE	Dawes	Denver Basin
31047	NE	Dawson	Cambridge Arch-Central Kansas Uplift
31049	NE	Deuel	Denver Basin
31051	NE	Dixon	Salina Basin
31053	NE	Dodge	Salina Basin
31055	NE	Douglas	Nemaha Uplift
31057	NE	Dundy	Cambridge Arch-Central Kansas Uplift
31059	NE	Fillmore	Salina Basin
31061	NE	Franklin	Salina Basin
31063	NE	Frontier	Cambridge Arch-Central Kansas Uplift
31065	NE	Furnas	Cambridge Arch-Central Kansas Uplift
31067	NE	Gage	Nemaha Uplift

FIPS Code	State	County	Basin
31069	NE	Garden	Denver Basin
31071	NE	Garfield	Salina Basin
31073	NE	Gosper	Cambridge Arch-Central Kansas Uplift
31075	NE	Grant	Cambridge Arch-Central Kansas Uplift
31077	NE	Greeley	Salina Basin
31079	NE	Hall	Salina Basin
31081	NE	Hamilton	Salina Basin
31083	NE	Harlan	Salina Basin
31085	NE	Hayes	Cambridge Arch-Central Kansas Uplift
31087	NE	Hitchcock	Cambridge Arch-Central Kansas Uplift
31089	NE	Holt	Salina Basin
31091	NE	Hooker	Cambridge Arch-Central Kansas Uplift
31093	NE	Howard	Salina Basin
31095	NE	Jefferson	Salina Basin
31097	NE	Johnson	Nemaha Uplift
31099	NE	Kearney	Salina Basin
31101	NE	Keith	Cambridge Arch-Central Kansas Uplift
31103	NE	Keya Paha	Salina Basin
31105	NE	Kimball	Denver Basin
31107	NE	Knox	Salina Basin
31109	NE	Lancaster	Salina Basin
31111	NE	Lincoln	Cambridge Arch-Central Kansas Uplift
31113	NE	Logan	Cambridge Arch-Central Kansas Uplift
31115	NE	Loup	Salina Basin
31117	NE	McPherson	Cambridge Arch-Central Kansas Uplift
31119	NE	Madison	Salina Basin
31121	NE	Merrick	Salina Basin
31123	NE	Morrill	Denver Basin
31125	NE	Nance	Salina Basin
31127	NE	Nemaha	Forest City Basin
31129	NE	Nuckolls	Salina Basin
31131	NE	Otoe	Nemaha Uplift
31133	NE	Pawnee	Nemaha Uplift
31135	NE	Perkins	Cambridge Arch-Central Kansas Uplift
31137	NE	Phelps	Salina Basin
31139	NE	Pierce	Salina Basin
31141	NE	Platte	Salina Basin
31143	NE	Polk	Salina Basin
31145	NE	Red Willow	Cambridge Arch-Central Kansas Uplift
31147	NE	Richardson	Forest City Basin

FIPS Code	State	County	Basin
31149	NE	Rock	Salina Basin
31151	NE	Saline	Salina Basin
31153	NE	Sarpy	Nemaha Uplift
31155	NE	Saunders	Salina Basin
31157	NE	Scotts Bluff	Denver Basin
31159	NE	Seward	Salina Basin
31161	NE	Sheridan	Denver Basin
31163	NE	Sherman	Salina Basin
31165	NE	Sioux	Denver Basin
31167	NE	Stanton	Salina Basin
31169	NE	Thayer	Salina Basin
31171	NE	Thomas	Cambridge Arch-Central Kansas Uplift
31173	NE	Thurston	Salina Basin
31175	NE	Valley	Salina Basin
31177	NE	Washington	Salina Basin
31179	NE	Wayne	Salina Basin
31181	NE	Webster	Salina Basin
31183	NE	Wheeler	Salina Basin
31185	NE	York	Salina Basin
40001	OK	Adair	Cherokee Platform
40003	OK	Alfalfa	Anadarko Basin
40005	OK	Atoka	Arkoma Basin
40007	OK	Beaver	Anadarko Basin
40009	OK	Beckham	Anadarko Basin
40011	OK	Blaine	Anadarko Basin
40013	OK	Bryan	Arkoma Basin
40015	OK	Caddo	Anadarko Basin
40017	OK	Canadian	Anadarko Basin
40019	OK	Carter	Southern Oklahoma
40021	OK	Cherokee	Cherokee Platform
40023	OK	Choctaw	Arkoma Basin
40025	OK	Cimarron	Palo Duro Basin
40027	OK	Cleveland	Nemaha Uplift
40029	OK	Coal	Arkoma Basin
40031	OK	Comanche	Southern Oklahoma
40033	OK	Cotton	Southern Oklahoma
40035	OK	Craig	Cherokee Platform
40037	OK	Creek	Cherokee Platform
40039	OK	Custer	Anadarko Basin
40041	OK	Delaware	Cherokee Platform

FIPS Code	State	County	Basin
40043	OK	Dewey	Anadarko Basin
40045	OK	Ellis	Anadarko Basin
40047	OK	Garfield	Anadarko Basin
40049	OK	Garvin	Southern Oklahoma
40051	OK	Grady	Anadarko Basin
40053	OK	Grant	Anadarko Basin
40055	OK	Greer	Anadarko Basin
40057	OK	Harmon	Bend Arch-Fort Worth Basin
40059	OK	Harper	Anadarko Basin
40061	OK	Haskell	Arkoma Basin
40063	OK	Hughes	Arkoma Basin
40065	OK	Jackson	Bend Arch-Fort Worth Basin
40067	OK	Jefferson	Southern Oklahoma
40069	OK	Johnston	Southern Oklahoma
40071	OK	Kay	Nemaha Uplift
40073	OK	Kingfisher	Anadarko Basin
40075	OK	Kiowa	Anadarko Basin
40077	OK	Latimer	Arkoma Basin
40079	OK	Le Flore	Arkoma Basin
40081	OK	Lincoln	Cherokee Platform
40083	OK	Logan	Nemaha Uplift
40085	OK	Love	Southern Oklahoma
40087	OK	McClain	Nemaha Uplift
40089	OK	McCurtain	Arkoma Basin
40091	OK	McIntosh	Arkoma Basin
40093	OK	Major	Anadarko Basin
40095	OK	Marshall	Southern Oklahoma
40097	OK	Mayes	Cherokee Platform
40099	OK	Murray	Southern Oklahoma
40101	OK	Muskogee	Cherokee Platform
40103	OK	Noble	Nemaha Uplift
40105	OK	Nowata	Cherokee Platform
40107	OK	Okfuskee	Cherokee Platform
40109	OK	Oklahoma	Nemaha Uplift
40111	OK	Okmulgee	Cherokee Platform
40113	OK	Osage	Cherokee Platform
40115	OK	Ottawa	Cherokee Platform
40117	OK	Pawnee	Cherokee Platform
40119	OK	Payne	Cherokee Platform
40121	OK	Pittsburg	Arkoma Basin

FIPS Code	State	County	Basin
40123	OK	Pontotoc	Arkoma Basin
40125	OK	Pottawatomie	Cherokee Platform
40127	OK	Pushmataha	Arkoma Basin
40129	OK	Roger Mills	Anadarko Basin
40131	OK	Rogers	Cherokee Platform
40133	OK	Seminole	Cherokee Platform
40135	OK	Sequoyah	Arkoma Basin
40137	OK	Stephens	Southern Oklahoma
40139	OK	Texas	Anadarko Basin
40141	OK	Tillman	Bend Arch-Fort Worth Basin
40143	OK	Tulsa	Cherokee Platform
40145	OK	Wagoner	Cherokee Platform
40147	OK	Washington	Cherokee Platform
40149	OK	Washita	Anadarko Basin
40151	OK	Woods	Anadarko Basin
40153	OK	Woodward	Anadarko Basin
48001	TX	Anderson	East Texas Basin
48003	TX	Andrews	Permian Basin
48005	TX	Angelina	East Texas Basin
48007	TX	Aransas	Western Gulf
48009	TX	Archer	Bend Arch-Fort Worth Basin
48011	TX	Armstrong	Palo Duro Basin
48013	TX	Atascosa	Western Gulf
48015	TX	Austin	Western Gulf
48017	TX	Bailey	Palo Duro Basin
48019	TX	Bandera	Bend Arch-Fort Worth Basin
48021	TX	Bastrop	Western Gulf
48023	TX	Baylor	Bend Arch-Fort Worth Basin
48025	TX	Bee	Western Gulf
48027	TX	Bell	Western Gulf
48029	TX	Bexar	Western Gulf
48031	TX	Blanco	Bend Arch-Fort Worth Basin
48033	TX	Borden	Permian Basin
48035	TX	Bosque	Bend Arch-Fort Worth Basin
48037	TX	Bowie	East Texas Basin
48039	TX	Brazoria	Western Gulf
48041	TX	Brazos	Western Gulf
48043	TX	Brewster	Marathon Thrust Belt
48045	TX	Briscoe	Palo Duro Basin
48047	TX	Brooks	Western Gulf

FIPS Code	State	County	Basin
48049	TX	Brown	Bend Arch-Fort Worth Basin
48051	TX	Burleson	Western Gulf
48053	TX	Burnet	Bend Arch-Fort Worth Basin
48055	TX	Caldwell	Western Gulf
48057	TX	Calhoun	Western Gulf
48059	TX	Callahan	Bend Arch-Fort Worth Basin
48061	TX	Cameron	Western Gulf
48063	TX	Camp	East Texas Basin
48065	TX	Carson	Anadarko Basin
48067	TX	Cass	East Texas Basin
48069	TX	Castro	Palo Duro Basin
48071	TX	Chambers	Western Gulf
48073	TX	Cherokee	East Texas Basin
48075	TX	Childress	Palo Duro Basin
48077	TX	Clay	Bend Arch-Fort Worth Basin
48079	TX	Cochran	Permian Basin
48081	TX	Coke	Permian Basin
48083	TX	Coleman	Bend Arch-Fort Worth Basin
48085	TX	Collin	Bend Arch-Fort Worth Basin
48087	TX	Collingsworth	Palo Duro Basin
48089	TX	Colorado	Western Gulf
48091	TX	Comal	Western Gulf
48093	TX	Comanche	Bend Arch-Fort Worth Basin
48095	TX	Concho	Bend Arch-Fort Worth Basin
48097	TX	Cooke	Bend Arch-Fort Worth Basin
48099	TX	Coryell	Bend Arch-Fort Worth Basin
48101	TX	Cottle	Palo Duro Basin
48103	TX	Crane	Permian Basin
48105	TX	Crockett	Permian Basin
48107	TX	Crosby	Permian Basin
48109	TX	Culberson	Permian Basin
48111	TX	Dallam	Palo Duro Basin
48113	TX	Dallas	Bend Arch-Fort Worth Basin
48115	TX	Dawson	Permian Basin
48117	TX	Deaf Smith	Palo Duro Basin
48119	TX	Delta	East Texas Basin
48121	TX	Denton	Bend Arch-Fort Worth Basin
48123	TX	DeWitt	Western Gulf
48125	TX	Dickens	Permian Basin
48127	TX	Dimmit	Western Gulf

FIPS Code	State	County	Basin
48129	TX	Donley	Palo Duro Basin
48131	TX	Duval	Western Gulf
48133	TX	Eastland	Bend Arch-Fort Worth Basin
48135	TX	Ector	Permian Basin
48137	TX	Edwards	Permian Basin
48139	TX	Ellis	Bend Arch-Fort Worth Basin
48141	TX	El Paso	Permian Basin
48143	TX	Erath	Bend Arch-Fort Worth Basin
48145	TX	Falls	East Texas Basin
48147	TX	Fannin	East Texas Basin
48149	TX	Fayette	Western Gulf
48151	TX	Fisher	Permian Basin
48153	TX	Floyd	Palo Duro Basin
48155	TX	Foard	Bend Arch-Fort Worth Basin
48157	TX	Fort Bend	Western Gulf
48159	TX	Franklin	East Texas Basin
48161	TX	Freestone	East Texas Basin
48163	TX	Frio	Western Gulf
48165	TX	Gaines	Permian Basin
48167	TX	Galveston	Western Gulf
48169	TX	Garza	Permian Basin
48171	TX	Gillespie	Bend Arch-Fort Worth Basin
48173	TX	Glasscock	Permian Basin
48175	TX	Goliad	Western Gulf
48177	TX	Gonzales	Western Gulf
48179	TX	Gray	Anadarko Basin
48181	TX	Grayson	Bend Arch-Fort Worth Basin
48183	TX	Gregg	East Texas Basin
48185	TX	Grimes	Western Gulf
48187	TX	Guadalupe	Western Gulf
48189	TX	Hale	Palo Duro Basin
48191	TX	Hall	Palo Duro Basin
48193	TX	Hamilton	Bend Arch-Fort Worth Basin
48195	TX	Hansford	Anadarko Basin
48197	TX	Hardeman	Bend Arch-Fort Worth Basin
48199	TX	Hardin	Western Gulf
48201	TX	Harris	Western Gulf
48203	TX	Harrison	East Texas Basin
48205	TX	Hartley	Palo Duro Basin
48207	TX	Haskell	Bend Arch-Fort Worth Basin

FIPS Code	State	County	Basin
48209	TX	Hays	Western Gulf
48211	TX	Hemphill	Anadarko Basin
48213	TX	Henderson	East Texas Basin
48215	TX	Hidalgo	Western Gulf
48217	TX	Hill	Bend Arch-Fort Worth Basin
48219	TX	Hockley	Permian Basin
48221	TX	Hood	Bend Arch-Fort Worth Basin
48223	TX	Hopkins	East Texas Basin
48225	TX	Houston	East Texas Basin
48227	TX	Howard	Permian Basin
48229	TX	Hudspeth	Permian Basin
48231	TX	Hunt	East Texas Basin
48233	TX	Hutchinson	Anadarko Basin
48235	TX	Irion	Permian Basin
48237	TX	Jack	Bend Arch-Fort Worth Basin
48239	TX	Jackson	Western Gulf
48241	TX	Jasper	Western Gulf
48243	TX	Jeff Davis	Permian Basin
48245	TX	Jefferson	Western Gulf
48247	TX	Jim Hogg	Western Gulf
48249	TX	Jim Wells	Western Gulf
48251	TX	Johnson	Bend Arch-Fort Worth Basin
48253	TX	Jones	Bend Arch-Fort Worth Basin
48255	TX	Karnes	Western Gulf
48257	TX	Kaufman	East Texas Basin
48259	TX	Kendall	Bend Arch-Fort Worth Basin
48261	TX	Kenedy	Western Gulf
48263	TX	Kent	Permian Basin
48265	TX	Kerr	Bend Arch-Fort Worth Basin
48267	TX	Kimble	Bend Arch-Fort Worth Basin
48269	TX	King	Permian Basin
48271	TX	Kinney	Western Gulf
48273	TX	Kleberg	Western Gulf
48275	TX	Knox	Bend Arch-Fort Worth Basin
48277	TX	Lamar	East Texas Basin
48279	TX	Lamb	Palo Duro Basin
48281	TX	Lampasas	Bend Arch-Fort Worth Basin
48283	TX	La Salle	Western Gulf
48285	TX	Lavaca	Western Gulf
48287	TX	Lee	Western Gulf

FIPS Code	State	County	Basin
48289	TX	Leon	East Texas Basin
48291	TX	Liberty	Western Gulf
48293	TX	Limestone	East Texas Basin
48295	TX	Lipscomb	Anadarko Basin
48297	TX	Live Oak	Western Gulf
48299	TX	Llano	Bend Arch-Fort Worth Basin
48301	TX	Loving	Permian Basin
48303	TX	Lubbock	Permian Basin
48305	TX	Lynn	Permian Basin
48307	TX	McCulloch	Bend Arch-Fort Worth Basin
48309	TX	McLennan	Bend Arch-Fort Worth Basin
48311	TX	McMullen	Western Gulf
48313	TX	Madison	Western Gulf
48315	TX	Marion	East Texas Basin
48317	TX	Martin	Permian Basin
48319	TX	Mason	Bend Arch-Fort Worth Basin
48321	TX	Matagorda	Western Gulf
48323	TX	Maverick	Western Gulf
48325	TX	Medina	Western Gulf
48327	TX	Menard	Bend Arch-Fort Worth Basin
48329	TX	Midland	Permian Basin
48331	TX	Milam	Western Gulf
48333	TX	Mills	Bend Arch-Fort Worth Basin
48335	TX	Mitchell	Permian Basin
48337	TX	Montague	Bend Arch-Fort Worth Basin
48339	TX	Montgomery	Western Gulf
48341	TX	Moore	Anadarko Basin
48343	TX	Morris	East Texas Basin
48345	TX	Motley	Palo Duro Basin
48347	TX	Nacogdoches	East Texas Basin
48349	TX	Navarro	East Texas Basin
48351	TX	Newton	Western Gulf
48353	TX	Nolan	Permian Basin
48355	TX	Nueces	Western Gulf
48357	TX	Ochiltree	Anadarko Basin
48359	TX	Oldham	Palo Duro Basin
48361	TX	Orange	Western Gulf
48363	TX	Palo Pinto	Bend Arch-Fort Worth Basin
48365	TX	Panola	East Texas Basin
48367	TX	Parker	Bend Arch-Fort Worth Basin

FIPS Code	State	County	Basin
48369	TX	Parmer	Palo Duro Basin
48371	TX	Pecos	Permian Basin
48373	TX	Polk	Western Gulf
48375	TX	Potter	Palo Duro Basin
48377	TX	Presidio	Permian Basin
48379	TX	Rains	East Texas Basin
48381	TX	Randall	Palo Duro Basin
48383	TX	Reagan	Permian Basin
48385	TX	Real	Bend Arch-Fort Worth Basin
48387	TX	Red River	East Texas Basin
48389	TX	Reeves	Permian Basin
48391	TX	Refugio	Western Gulf
48393	TX	Roberts	Anadarko Basin
48395	TX	Robertson	East Texas Basin
48397	TX	Rockwall	East Texas Basin
48399	TX	Runnels	Bend Arch-Fort Worth Basin
48401	TX	Rusk	East Texas Basin
48403	TX	Sabine	East Texas Basin
48405	TX	San Augustine	East Texas Basin
48407	TX	San Jacinto	Western Gulf
48409	TX	San Patricio	Western Gulf
48411	TX	San Saba	Bend Arch-Fort Worth Basin
48413	TX	Schleicher	Permian Basin
48415	TX	Scurry	Permian Basin
48417	TX	Shackelford	Bend Arch-Fort Worth Basin
48419	TX	Shelby	East Texas Basin
48421	TX	Sherman	Anadarko Basin
48423	TX	Smith	East Texas Basin
48425	TX	Somervell	Bend Arch-Fort Worth Basin
48427	TX	Starr	Western Gulf
48429	TX	Stephens	Bend Arch-Fort Worth Basin
48431	TX	Sterling	Permian Basin
48433	TX	Stonewall	Permian Basin
48435	TX	Sutton	Permian Basin
48437	TX	Swisher	Palo Duro Basin
48439	TX	Tarrant	Bend Arch-Fort Worth Basin
48441	TX	Taylor	Bend Arch-Fort Worth Basin
48443	TX	Terrell	Marathon Thrust Belt
48445	TX	Terry	Permian Basin
48447	TX	Throckmorton	Bend Arch-Fort Worth Basin

FIPS Code	State	County	Basin
48449	TX	Titus	East Texas Basin
48451	TX	Tom Green	Permian Basin
48453	TX	Travis	Western Gulf
48455	TX	Trinity	Western Gulf
48457	TX	Tyler	Western Gulf
48459	TX	Upshur	East Texas Basin
48461	TX	Upton	Permian Basin
48463	TX	Uvalde	Western Gulf
48465	TX	Val Verde	Permian Basin
48467	TX	Van Zandt	East Texas Basin
48469	TX	Victoria	Western Gulf
48471	TX	Walker	Western Gulf
48473	TX	Waller	Western Gulf
48475	TX	Ward	Permian Basin
48477	TX	Washington	Western Gulf
48479	TX	Webb	Western Gulf
48481	TX	Wharton	Western Gulf
48483	TX	Wheeler	Anadarko Basin
48485	TX	Wichita	Bend Arch-Fort Worth Basin
48487	TX	Wilbarger	Bend Arch-Fort Worth Basin
48489	TX	Willacy	Western Gulf
48491	TX	Williamson	Western Gulf
48493	TX	Wilson	Western Gulf
48495	TX	Winkler	Permian Basin
48497	TX	Wise	Bend Arch-Fort Worth Basin
48499	TX	Wood	East Texas Basin
48501	TX	Yoakum	Permian Basin
48503	TX	Young	Bend Arch-Fort Worth Basin
48505	TX	Zapata	Western Gulf
48507	TX	Zavala	Western Gulf

APPENDIX B

Field Names for Production Data from HPDI

Appendix B: Field Names for Production Data from HPDI

Area source categories in the current inventory were assigned source classification code(s) (SCC) that best described the emissions source analyzed. The SCCs designation aids in the submission of emissions for the NEI. Some source categories are characterized by more than one SCC and thus emissions were estimated separately to fit an SCC description. Often source categories will be independently estimated by well type (gas versus oil), thus resulting in two SCCs for similar equipment/source. Other examples include wellhead and lateral compressors, as well as fugitives, which are assigned different SCCs depending on equipment characteristics.

Table B-1. Field Names and Descriptions in the Production Well Table in the EPA Enforcement Universe Database (created from HPDI).

Field Name	Description
ENTITY_ID	HPDI assigned unique property ID. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
API_NO	API assigned number of a well on the property.
PROPERTY_TYPE	Property type (e.g., lease, unit, well, completion, other, unknown). Note: for instances where duplicate API numbers were combined, the minimum value was selected.
PRODUCTION_TYPE	Production type (e.g., oil, gas, coalbed methane, injection). Note: for instances where duplicate API numbers were combined, the production type fields are comma separated.
WELL_NAME	Operator assigned well/lease name of the property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LEASE_NO	State number assigned to the property or lease or unit the property is part of. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
WELL_NO	Operator assigned well number of the property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
CURR_OPER_NAME	Current operator name. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LIQ_GATH_NAME_1	Current primary liquid gatherer for a property. Note: for instances where duplicate API numbers were combined, the production type fields are comma separated.
GAS_GATH_NAME_1	Current primary gas gatherer for a property. Note: for instances where duplicate API numbers were combined, the production type fields are comma separated.
COMMON_OPER_NAME	Corporate entity that is determined by HPDI to own the current operator. Note: for instances where duplicate API numbers were combined, the minimum value was selected.

Field Name	Description
LATITUDE	Surface latitude the property is located in; for multi-well properties HPDI picked a well to designate the location of the property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LONGITUDE	Surface longitude the property is located in; for multi-well properties HPDI picked a well to designate the location of the property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LATITUDE_BOTM	Bottom hole latitude of the property; for multi-well properties HPDI picked a well to designate the location of the property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LONGITUDE_BOTM	Bottom hole longitude of the property; for multi-well properties HPDI picked a well to designate the location of the property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LOCATION	Township range of property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
COUNTY	County the property is located in. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
DISTRICT	District within a given state the property is assigned. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
STATE	State the property is located in. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
SECTION	Section property is located in. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
QTR_QTR	Quarter-quarter the property is located in (note: Texas only). Note: for instances where duplicate API numbers were combined, the minimum value was selected.
MERID	Meridian legal description is referenced from. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
OFFSHORE	Offshore waters indicator. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
FIELD	Field name the property is reporting from. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
RESERVOIR	Reservoir, formation, zone, or pool that the property is reported as producing from. Note: for instances where duplicate API numbers were combined, the minimum value was selected.

Field Name	Description
FORMATION	Formation that the property is reported as producing from. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
BASIN	Basin the property is located in. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
STATUS	Current status of the well (e.g., active, inactive, shut in). See **Error! Reference source not found.** for the status codes and descriptions. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
SPUD_DATE	Latest date drilling commenced on property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
DRILL_TYPE	Drill type (e.g., horizontal, vertical, directional). See **Error! Reference source not found.** for the drill type codes and descriptions. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
COMPLETION_DATE	Latest completion date of the property. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
TOTAL_DEPTH	Total depth the property was drilled to. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LAST_PROD_DATE	Last date HPDI has reported production for the property. Note: Even though the date may be represented as mm/dd/yyyy, it is for the month listed, not just the individual day. For example, production through December 2009 is listed as 12/1/2009.
LATEST_FLOW_PRESSURE	Latest flow pressure reported. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
LATEST_WHSIP	Latest well head shut-in pressure reported. Note: for instances where duplicate API numbers were combined, the minimum value was selected.
SumOfLIQ_DAILY	Average daily liquid production in last 12 months, summed over duplicate API numbers.
SumOfGAS_DAILY	Average daily gas production in last 12 months, summed over duplicate API numbers.
SumOfLIQ_CUM	Cumulative liquid production of property, reported in bbl, summed over duplicate API numbers.
SumOfGAS_CUM	Cumulative gas production of property, reported in MCF, summed over duplicate API numbers.
SumOfWRT_CUM	Cumulative water production of property, summed over duplicate API numbers.

Field Name	Description
SumOfLIQ_YEAR	Liquid production, reported in bbls, for the 12 months ending with LAST_PROD_DATE, summed over duplicate API numbers.
SumOfGAS_YEAR	Gas production, reported in MCF, for the 12 months ending with LAST_PROD_DATE, summed over duplicate API numbers.
SumOfWTR_YEAR	Water production, reported in bbls, for the 12 months ending with LAST_PROD_DATE, summed over duplicate API numbers.
SumOfLIQ07	Liquid production, reported in bbls, for 2007, summed over duplicate API numbers.
SumOfGAS07	Gas production, reported in MCF, for 2007, summed over duplicate API numbers.
SumOfWTR07	Water production, reported in bbls, for 2007, summed over duplicate API numbers.
SumOfLIQ08	Liquid production, reported in bbls, for 2008, summed over duplicate API numbers.
SumOfGAS08	Gas production, reported in MCF, for 2008, summed over duplicate API numbers.
SumOfWTR08	Water production, reported in bbls, for 2008, summed over duplicate API numbers.
SumOfLIQ09	Liquid production, reported in bbls, for 2009, summed over duplicate API numbers.
SumOfGAS09	Gas production, reported in MCF, for 2009, summed over duplicate API numbers.
SumOfWTR09	Water production, reported in bbls, for 2009, summed over duplicate API numbers.
SumOfLIQ10	Liquid production, reported in bbls, for 2010, summed over duplicate API numbers.
SumOfGAS10	Gas production, reported in MCF, for 2010, summed over duplicate API numbers.
SumOfWTR10	Water production, reported in bbls, for 2010, summed over duplicate API numbers.
SumOfLIQ11	Liquid production, reported in bbls, for 2011, summed over duplicate API numbers.
SumOfGAS11	Gas production, reported in MCF, for 2011, summed over duplicate API numbers.
SumOfWTR11	Water production, reported in bbls, for 2011, summed over duplicate API numbers.
SumOfLIQ12	Liquid production, reported in bbls, for 2012, summed over duplicate API numbers.
SumOfGAS12	Gas production, reported in MCF, for 2012, summed over duplicate API numbers.

Field Name	Description
SumOfWTR12	Water production, reported in bbls, for 2012, summed over duplicate API numbers.
PROD09_FLAG	Yes/No flag indicating if liquid and/or gas production was greater than zero in 2009.
PROD10_FLAG	Yes/No flag indicating if liquid and/or gas production was greater than zero in 2010.
PROD11_FLAG	Yes/No flag indicating if liquid and/or gas production was greater than zero in 2011.
PROD12_FLAG	Yes/No flag indicating if liquid and/or gas production was greater than zero in 2012.
ACTIVE_FLAG	Yes/No flag indicating active status based on latest production date.
ACTIVE_PROD_FLAG	Yes/No flag indicating whether entity produced liquid and/or gas in 2009-2012, using the production flags.
SHALE_FLAG	Yes/No flag for Pennsylvania only indicating if the type of production is shale gas.
INITIAL_OIL	Initial oil production. Note: Only for Indiana and Illinois.
INITIAL_GAS	Initial gas production. Note: Only for Indiana and Illinois.
INITIAL_WATER	Initial water production. Note: Only for Indiana and Illinois.
TEST_DATE	Date of the most recent well test.
TEST_TIMES_TESTED	Total number of times the well was tested.
TEST_GAS_CUM	Cumulative reported gas at the time of the most recent well test.
TEST_GOR	Gas to oil ratio at the time of the most recent well test.
TEST_FLOW_PRES	Well head flowing pressure at the time of the most recent well test.
TEST_FLOWOZ	Flowing pressure divided by Z-Factor at the time of the most recent well test.
TEST_WHSIP	Well head shut-in pressure at the time of the most recent well test.
TEST_SIPOZ	Bottom hole pressure divided by the Z-Factor, if well head shut-in pressure is provided at the time of the most recent well test.
TEST_GAS_GRAVITY	Gas gravity at the time of the most recent well test.
TEST_LIQ_GRAVITY	Liquid gravity at the time of the most recent well test.
TEST_GAS_VOLUME	Daily gas production at the time of the most recent well test.
TEST_LIQ_VOLUME	Daily water production at the time of the most recent well test.
TEST_WAT_VOLUME	Daily liquid production at the time of the most recent well test.
TEST_TYPE	Type of test conducted for the most recent well test.
TEST_CHOKE_SIZE	Choke used during the most recent well test.
TEST_TBG_PRES	Pressure present in the tubing at the time of the most recent well test.
HUC12_CODE	EPA populated field.
Indian_Lands	EPA populated field.

Field Name	Description
Federal_Lands	EPA populated field.
Percent_Minority	EPA populated field.
Sole_Source_Aquifer	EPA populated field.
Water_Protection_Area	EPA populated field.
NA_Pollution_Code	EPA populated field.

APPENDIX C

Electronic Appendix: Industry survey forms (Excel Workbooks)

APPENDIX D

Electronic Appendix: CenSARA Emissions Calculator Tools (Excel Workbooks)

Appendix B-5

Development of 2011 Aircraft Component for National Emissions Inventory

www.erg.com

MEMORANDUM

TO: Laurel Driver/US EPA

FROM: Roger Chang, Jennifer Sellers, Heather Perez, and Richard Billings/ERG

DATE: June 17, 2013

SUBJECT: Development of 2011 Aircraft Component for National Emissions Inventory

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1.0 Introduction

The U.S. Environmental Protection Agency (EPA), issued Work Assignment (WA) 2-04, "Improving C1/C2 Commercial Marine Activity and Emission Estimates" under EPA Contract Number EPA-EP-D-11-006, to Eastern Research Group, Inc. (ERG) to support the development of the 2011 commercial marine vessel and aircraft components of the National Emission Inventory (NEI). This report documents procedures used for the aviation component of WA 2-04 and is a deliverable under WA 3-01 "Mobile Source Emission Inventory Development FY13".

2.0 Compilation of Activity Data

ERG compiled 2011 landing and takeoff (LTO) data from T-100 aircraft dataset for aircraft specific commercial air traffic and air taxis data, and terminal area forecast (TAF) and Air Traffic Activity Data System (ATADS) for generic commercial and military traffic data. Office of Transportation and Air Quality (OTAQ) provided 5010, TAF, and ATADS LTO data for piston engine and jet aircraft associated with general aviation and air taxis. Documentation of OTAQ's approach for developing their activity data set is provided in Appendix A.

Because NEI focuses on airports as point sources, aircraft emissions are needed for the approach, landing, taxiing, idling, take off and climb-out; typical modes in a landing and take-off cycle (LTO). For this reason the required activity data are LTOs. The LTO data are general available in two formats, 1) aircraft specific data typically obtained from the T-100 data which can be applied to the FAA's Emissions and Dispersion Modeling System (EDMS) and 2) generic aircraft type (i.e., air carriers, air taxis, general aviation and military aircraft) operational data (i.e., landings and takeoffs which must be summed and divided by two to be equivalent with an LTO cycle) that can be applied to EPA aircraft type (i.e., commercial, air taxis, general aviation and military) emission factors and speciation profiles.

The T-100 aircraft specific data were identified as either commercial air carrier or air taxi aircraft based on the passenger capacity of the aircraft. The air carrier and air taxi LTOs were summed by aircraft type for each airport and compared to the commercial and air taxi data from TAF and ATADS. Note that the quality of the ATADS data is considered to be better than the

TAF data as it is derived from activity reports from FAA towered facilities. For this reason, LTO data for ATADS airports replaced any duplicate TAF data.

If the TAF/ATADS LTO value was greater than the T-100 value for a specific aircraft type and airport, then the T-100 value was subtracted from the TAF/ATADS value. If the T-100 value was greater than or equal to the TAF value, then the TAF value was set to zero. Note the data source of the LTO data used for the 2011 aircraft LTO data set and adjustments are presented in the Table 1 provided below:

Table 1. NEI 2011 LTO Activity Corrections/Adjustments

Aircraft Type	**Data sources**				**Required Adjustment**		
	ATADS	**TAF**	**T100**	**OTAQ**			
Air Carrier	✓	✓	✓		Replace TAF w/ ATADS where possible	If ATADS/TAF > T100, use T100 with EDMS and subtract T100 from ATADS/TAF and use generic approach	If ATADS/TAF <= T100, use T100 with EDMS, and set ATADS/TAF to zero
Military	✓	✓			Replace TAF w/ ATADS where possible	Add military LTOs to data set	
Air Taxi			✓	✓	ATADS/TAF replacement already implemented by OTAQ	If OTAQ > T100, use = T100 with EDMS and subtract T100 from OTAQ and use generic approach	If OTAQ <= T100, use T100 with EDMS and set OTAQ to zero0
General Aviation				✓	ATADS/TAF already implemented by OTAQ data	Use OTAQ, no adjustment	

The data was compiled into a user friendly database for EPA review. Airports or aircraft engine configurations added since 2008 were clearly identified as then needed to be added to the EPA's Emission Inventory System (EIS).

The national LTO data were posted for states to review. Instructions that delineate the review process were included with the posted data and are provided in Appendix B. State/local/tribal agencies provided local LTO data as deletions, additions or changes to the national LTO data for their jurisdiction. State/local/tribal agency submitted data were evaluated and if appropriate, were pulled into the national LTO data file.

Table 2 lists the state/local/tribal agencies that provided data or comments.

Table 2. Agencies That Provided Activity Data or Commented on Data

State	Affiliation
CA	Planning & Evaluation Division, Ventura County APCD
CT	Technical Services Group, Bureau of Air Management, Connecticut Department of Energy and Environmental Protection
GA	Air Branch, Planning & Support GA Environmental Protection Division
KS	Air Inventory Modeling Unit, Kansas Department of Health & Environment
MD	Maryland Department of the Environment
NH	New Hampshire Department of Environmental Services
NJ	NJ Department of Environmental Protection
NV	Air Quality Management Division, Washoe County Health District
VA	Virginia Dept of Environmental Quality
VT	Vermont Air Pollution Control Division
WA	Air Quality Program, Department of Ecology
WI	Regional Pollutant and Mobile Sources Section, Bureau of Air Management, Wisconsin Department of Natural Resources

Appendix C includes the detailed LTO data submitted by states.

The final LTO database with state data incorporated was then compared to the LTO data in the 2008 inventory. Table 3 summarizes the LTO comparison.

Table 3. 2008 and 2011 LTO Comparison

SCC	SCC Description	2008 LTO	2011 LTO	Percent Difference
2275001000	Aircraft/Military	2,456,334	2,638,781	7.43%
2275020000	Aircraft/Commercial	9,311,618	8,414,082	-9.64%
2275050011	Aircraft /General Aviation /Piston	31,933,200	30,092,114	-5.77%
2275050012	Aircraft /General Aviation /Turbine	11,760,959	10,892,174	-7.39%
2275060011	Aircraft /Air Taxi /Piston	1,272,953	1,766,409	38.76%
2275060012	Aircraft /Air Taxi /Turbine	4,008,681	5,021,939	25.28%
Total		60,743,746	58,825,499	-3.16%

3.0 Emission Estimating Procedures

Prior to implementing the emission calculations, ERG quality checked the input data to ensure that they were correctly compiled and reasonable. Once the LTO data had been finalized, the aircraft specific data were run in EDMS to estimate criteria, greenhouse gas (GHG) and

hazardous air pollutant (HAP) emission from aircraft engine exhaust, auxiliary power units, and ground support equipment. Where aircraft-specific data were not available, aircraft type LTO data were applied to generic profiles which were developed in WA 5-07 and reviewed by OTAQ staff. The generic aircraft type emission factors used in this inventory are provided in Appendix D.

The emission estimates were quality checked to ensure that they have been calculated correctly and the results are reasonable. It is important to note that the emission factors for some of the pollutants were updated between the 2008 and 2011 inventories, which explain some of the larger differences. Table 4 summarizes the emission comparison.

Table 4. 2008 and 2011 Emissions Comparison

Pollutant Name	2008 Emissions (Ton)	2011 Emissions (Ton)	Percent Difference
Carbon Dioxide		29,944,090.82	
Carbon Monoxide	496,887.90	491,012.22	-1.18%
Nitrogen Oxides	122,801.19	123,614.15	0.66%
PM10 Primary (Filt + Cond)	9,488.70	9,196.61	-3.08%
PM2.5 Primary (Filt + Cond)	3,464.61	7,899.43	128.00%
Sulfur Dioxide	12,050.78	14,660.55	21.66%
Volatile Organic Compounds	27,754.66	31,788.14	14.53%
1,3-Butadiene	330.20	443.83	34.41%
1-Methylnaphthalene	43.19	59.26	37.20%
2,2,4-Trimethylpentane	56.90	36.68	-35.53%
2-Methylnaphthalene	36.02	49.43	37.20%
Acenaphthene	0.52	2.85	443.16%
Acenaphthylene	2.96	16.06	443.16%
Acetaldehyde	794.02	1,081.82	36.25%
Acrolein	160.52	602.64	275.44%
Anthracene	0.61	3.31	442.48%
Benz[a]Anthracene	0.073	0.39	438.21%
Benzene	486.79	573.11	17.73%
Benzo[a]Pyrene	0.072	0.39	439.65%
Benzo[b]Fluoranthene	0.087	0.47	438.20%
Benzo[g,h,i,]Perylene	0.19	1.01	443.11%
Benzo[k]Fluoranthene	0.087	0.47	438.20%
Chrysene	0.073	0.39	438.22%
Cumene	0.19	0.72	270.36%
Dibenzo[a,h]Anthracene		0.00069	
Ethyl Benzene	56.79	100.92	77.71%
Fluoranthene	0.66	3.55	440.96%
Fluorene	1.08	5.89	443.16%
Formaldehyde	2,322.09	3,155.72	35.90%

Table 4. 2008 and 2011 Emissions Comparison

Pollutant Name	2008 Emissions (Ton)	2011 Emissions (Ton)	Percent Difference
Hexane	21.68	20.68	-4.61%
Indeno[1,2,3-c,d]Pyrene	0.058	0.31	435.15%
Lead	254.45	244.78	-3.80%
Methane	120.42	124.56	3.44%
Methanol	116.94	433.09	270.36%
m-Xylene	98.16	110.39	12.47%
Naphthalene	116.43	455.69	291.38%
o-Xylene	53.97	61.08	13.16%
Phenanthrene	1.84	9.92	439.66%
Phenol	47.03	175.61	273.37%
Propionaldehyde	140.55	188.50	34.12%
Pyrene	0.89	4.84	441.19%
Styrene	65.71	86.56	31.75%
Toluene	541.22	530.15	-2.04%
Xylenes (Mixed Isomers)	211.47	173.08	-18.15%

4.0 Emission Data Formatting

A dataset of the emissions estimates were provided to the EPA WAM and OTAQ for review. A final dataset that incorporates any changes recommended by the EPA WAM or OTAQ staff was compiled and provided to the WAM for inclusion into EIS staging tables.

5.0 Emission Summary

Table 5 summarizes the total annual emissions from airports. More detailed emissions data, which include SCCs, are provided in Appendix E.

Table 5. Total Annual Emissions from Airports

Pollutant Name	Pollutant Code	Emissions (Ton)
Carbon Dioxide	CO2	29,944,090.82
Carbon Monoxide	CO	491,012.22
PM10 Primary (Filt + Cond)	PM_{10}-PRI	9,196.61
PM2.5 Primary (Filt + Cond)	PM_{25}-PRI	7,899.43
Nitrogen Oxides	NO_X	123,614.15
Sulfur Dioxide	SO_2	14,660.55
Volatile Organic Compounds	VOC	31,788.14
1,3-Butadiene	106990	443.83
1-Methylnaphthalene	90120	59.26
2,2,4-Trimethylpentane	540841	36.68

Table 5. Total Annual Emissions from Airports

Pollutant Name	Pollutant Code	Emissions (Ton)
2-Methylnaphthalene	91576	49.43
Acenaphthene	83329	2.85
Acenaphthylene	208968	16.06
Acetaldehyde	75070	1,081.82
Acrolein	107028	602.64
Anthracene	120127	3.31
Benz[a]Anthracene	56553	0.39
Benzene	71432	573.11
Benzo[a]Pyrene	50328	0.39
Benzo[b]Fluoranthene	205992	0.47
Benzo[g,h,i,]Perylene	191242	1.01
Benzo[k]Fluoranthene	207089	0.47
Chrysene	218019	0.39
Cumene	98828	0.72
Dibenzo[a,h]Anthracene	53703	0.00069
Ethyl Benzene	100414	100.92
Fluoranthene	206440	3.55
Fluorene	86737	5.89
Formaldehyde	50000	3,155.72
Hexane	110543	20.68
Indeno[1,2,3-c,d]Pyrene	193395	0.31
Lead	7439921	244.78
Methane	CH4	124.56
Methanol	67561	433.09
m-Xylene	108383	110.39
Naphthalene	91203	455.69
o-Xylene	95476	61.08
Phenanthrene	85018	9.92
Phenol	108952	175.61
Propionaldehyde	123386	188.50
Pyrene	129000	4.84
Styrene	100425	86.56
Toluene	108883	530.15
Xylenes (Mixed Isomers)	1330207	173.08

Appendix A - Documentation of Calculating Piston-Engine Aircraft Activity for the Draft 2011 National Emissions Inventory

Calculating Piston-Engine Aircraft Activity for the Draft 2011 National Emissions Inventory

June 2012

Section 1. Introduction

The main purpose of this document is to describe the methods the Environmental Protection Agency (EPA) used to calculate airport piston-engine activity inventories for the draft 2011 National Emissions Inventory (NEI).[1] These methods focus on the development of approaches to estimate piston-engine aircraft activity at airports in the U.S. since the activity of this fleet is reported to the Federal Aviation Administration (FAA) as general aviation (GA) or air taxi (AT) activity – categories that also include jet-engine aircraft activity. The methods described here are largely the same as those used to construct the 2008 NEI.

Background information regarding the use of leaded aviation gasoline (avgas) in piston-engine powered aircraft is available in other documents.[2,3] Briefly, most piston-engine aircraft operations fall into the categories of either GA or AT. Aircraft used in GA and AT activities include a diverse set of aircraft types and engine models and are used in a wide variety of applications.[4] Lead emissions associated with GA and AT aircraft stem from the use of one hundred octane low lead (100LL) avgas. The lead is added to the fuel in the form of tetraethyl lead (TEL). This lead additive helps boost fuel octane, prevent engine knock, and prevent valve seat recession and subsequent loss of compression for engines without hardened valves. Today, 100LL is the most commonly available type of aviation gasoline in the United States.[5] Lead is not added to jet fuel that is used in commercial aircraft, most military aircraft, or other turbine-engine powered aircraft.

This document is organized into five sections. Section 2 describes the landing and takeoff data we use to calculate airport-specific activity. Section 3 describes how we estimate landing and takeoff data for the airport facilities that do not report it to the FAA. Section 4 describes the estimate of landing and takeoff activity occurring at heliports in the U.S. and Section 5 describes the data we use to calculate the number of landings and takeoffs that are conducted by piston-engine aircraft.

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[1] In this document 'draft 2011 NEI' refers to the draft 2011 NEI data, available at: http://www.epa.gov/ttn/chief/net/2011inventory.html
[2] EPA (2007) Review of the National Ambient Air Quality Standards for Lead: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper. EPA-452/R-07-013 November 2007. pp 2-8 and 2-9.
[3] FAA William J. Hughes Technical Center http://www.tc.faa.gov/act4/insidethefence/2006/0609_06_AvFuels.htm
[4] Commercial aircraft include those used for scheduled service transporting passengers, freight, or both. Air taxis fly scheduled and for-hire service carrying passengers, freight or both, but they usually are smaller aircraft than those operated by commercial air carriers. General aviation includes most other aircraft (fixed and rotary wing) used for personal transportation, business, instructional flying, and aerial application.
[5] ChevronTexaco (2005) Aviation Fuels Technical Review. FTR-3. http://www.chevronglobalaviation.com/docs/aviation_tech_review.pdf

Section 2. Landing and Takeoff Data Sources and Uses

Airport-specific inventories require information regarding landing and takeoff (LTO) activity by aircraft type.[6] According to FAA records, there are approximately 20,000 airport facilities in the U.S., the vast majority of which are expected to have activity by piston-engine aircraft that operate on leaded avgas.

FAA's Office of Air Traffic provides a complete listing of operational airport facilities in the National Airspace System Resources (NASR) database. The electronic NASR data report, referred to here as the 5010 airport data report, can be generated from the NASR database and is available for download from the FAA website.[7] This report is updated every 56 days. EPA obtains airport information (including operations) for a subset of the facilities in the NASR database from FAA's Terminal Area Forecast (TAF) database that is prepared by FAA's Office of Aviation Policy and Plans.[8] The TAF database currently includes information for airports in FAA's National Plan of Integrated Airport Systems (NPIAS), which identifies airports that are significant to national air transportation. Approximately 500 of the airports that are in the TAF database have either an FAA air traffic control tower or an FAA contract tower where controllers count operations. The operations data from the control towers is reported to The Operations Network (OPSNET)[9] which is publically available in the Air Traffic Activity System (ATADS) database.[10] The operations data for the towered airports that is reported in OPSNET and ATADS is then reported to the TAF database. The operations data for the airports in the TAF database that do not have control towers represent estimates.[11] The operations supplied in the 5010 airport data report for facilities not reported in the TAF may be self-reported by airport operators through data collection accomplished by airport inspectors who work for the State Aviation Agency, or operations data can be obtained through other means.[12]

The 5010 airport data report supplies the date that the associated operations data represents.[13] Because airports that are not in the TAF database submit data voluntarily to FAA for the 5010 data report, many of the airports have operations data that represent data for years earlier than 2011. Nationally, piston-engine operations have decreased in recent years,[14]

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[6] An aircraft operation is defined as any landing or takeoff event, therefore, to calculate LTOs, operations are divided by two. Most data sources from FAA report aircraft activity in numbers of operations which, for the purposes of calculating lead emissions using the method described in this document, need to be converted to LTO events.
[7] http://www.faa.gov/airports_airtraffic/airports/airport_safety/airportdata_5010/
[8] http://aspm.faa.gov/main/taf.asp
[9] http://aspm.faa.gov/opsnet/sys/
[10] http://aspm.faa.gov/opsnet/sys/Airport.asp
[11] FAA's Terminal Area Forecast Summary (Fiscal Years 2011 – 2040), Appendix A (page 28) http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY20112040.pdf
[12] In the absence of updated information from States, local authorities or Tribes, we are using the LTO data provided in the FAA database.
[13] The 12-month ending date on which annual operations data in the report is based.
[14] http://www.faa.gov/data_research/aviation_data_statistics/general_aviation/

therefore EPA did not use GA operations data from years prior to 2011 as it is reported. Instead, EPA multiplied the older GA piston-engine data (Section 5 describes the method EPA used to calculate the number of piston-engine operations from total GA and AT activity data) by scaling factors that were calculated by dividing the 2011 national amount of avgas produced by the national amount of avgas produced in the year the operations data represents.[15] A table with the scaling factors is provided in Attachment A. The national volume of avgas produced data comes from the DOE, EIA website and is available for 1981 – 2011.[16] For operations data older than 1981, EPA divided the 2011 national amount of avgas produced by the average of the national amount of avgas produced from 1981 – 1989. Jet engines do not use avgas, therefore EPA did not apply scaling factors to the turbine operations for data from years prior to 2011.

The 2011 draft NEI was developed using the February 7, 2012 version of the 5010 airport data report. In that version of the report there were 19,782 airport facilities in the U.S. that had submitted data to the FAA. Among these 19,782 facilities, 69 facilities were not relevant for the purposes of estimating lead emissions because they were either listed as closed (56) or they were balloonports (13).[17] Therefore, lead inventories were needed for 19,714 facilities.[18] In the February 7, 2012 version of the 5010 airport data report, the 2011 TAF, and 2011 ATADS data there were a total of 5,627 airport facilities for which operations data were provided (many of which are facilities in FAA's TAF database).[19] There were 14,087 facilities in the 5010 airport data report and the 2011 TAF data for which there were no operations data.[20] Section 3 of this document describes the method EPA used to estimate operations for the 8,430 airport facilities in the draft 2011 NEI that do not have reported activity data. Section 4 describes the method EPA used to estimate operations for the 5,557 heliport facilities in the draft 2011 NEI that do not have reported activity data.[21]

As described in Section 1, most piston-engine aircraft fall into the categories of either GA or AT. Some GA and AT activity is conducted by turboprop and turbojet aircraft which do not used leaded avgas. There are no national databases that provide airport-specific LTO activity data for piston-engine aircraft separately from turbojet and turboprop aircraft. The databases described above report total GA

[15] The FAA General Aviation and Air Taxi (Part 135) Activity Surveys (source of national level piston-engine operations data) are only available annually, starting in 1999. Because there are airports with operations data older than 1999, EPA used avgas product supplied data as a surrogate for piston-engine operations to estimate the change in piston-engine activity over the last three decades.
[16] http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=mgaupus1&f=A. DOT recently changed the way they estimate fuel consumption data, so while EPA used DOT data to determine the 2011 national avgas lead inventory, for the purpose of calculating these scaling factors EPA used DOE's data in order to have historical fuel data that is calculated in a consistent manner.
[17] Balloon craft do not use avgas
[18] There was one facility in FAA's TAF database (72S) that was not in the 5010 Data Report, so the sum of 19,714 plus 69 is one larger than the 19,782 in the downloaded FAA 5010 Data Report.
[19] Either GA Itinerant, GA Local, or Air Taxi operations data, as these operations can be performed by piston-engine aircraft.
[20] No GA Itinerant, GA Local, or Air Taxi operations data.
[21] There are 100 facilities in the NPIAS report that have both 0 GA and 0 AT operations; however, EPA did not estimate operations for these 100 facilities.

and AT activity conducted by both piston-engine and jet-engine aircraft. Section 5 describes how we estimate piston-engine LTOs at airports in the draft 2011 NEI.

Section 3. Estimating LTOs at the 8,430 Airport Facilities with No LTO Data

FAA has used regression models to estimate operations at facilities where operations data are not available.[22,23] In this work and other work, FAA identified characteristics of small towered airports for which there were statistically significant relationships with operations at these airports.[24] Regression models based on the airport characteristics were then used to estimate general aviation operations for a set of non-towered airports. The airport characteristics identified by FAA and used to estimate general aviation operations at small airports include: the number of aircraft based at a facility (termed 'based aircraft'), population in the vicinity of the airport, airport regional prominence, per capita income, region, and the presence of certificated flight schools.

In the 2000 report titled 'Model for Estimating General Aviation Operations at Non-towered Airports,' a model of GA annual activity was developed using information from small towered airports to explain GA activity at towered and non-towered airports. The model explained GA activity at the towered airports well (R^2 of 0.75) but produced higher estimates than state-supplied estimates for non-towered airports.[25]

The relevant data available in the 5010 airport data report for the purposes of estimating airport operations include: facility type (airport, balloonport, seaplane base, gliderport, heliport, stolport,[26] ultralight); number of GA aircraft based at each airport by type (glider, helicopter, jet engine, military, multi-engine, single engine, ultralight); operations data (air taxi, commercial, commuter, GA itinerant, GA local, military)[27]; and operations date (12-month ending date on which annual operations data is based). 2010 U.S. Census data was also merged with the 5010 airport data report to give population data for each airport's county.

Using the FAA work referenced above, we explored relationships among the airport data variables that best predicted aircraft activity (LTOs). We found that based aircraft was a highly significant and positive regressor to LTOs. Table 1 shows that for non-heliport facilities that did not have LTO data in the February 7, 2012 version of the 5010 airport data report, 6,314 had based aircraft data while 2,216

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[22] Federal Aviation Administration, Office of Aviation Policy and Plans, Statistics and Forecast Branch. July 2001. Model for Estimating General Aviation Operations at Non-towered Airports Using Towered and Non-towered Airport Data. Prepared by GRA, Inc.
[23] Mark Hoekstra, "Model for Estimating General Aviation Operations at Non-Towered Airports" prepared for FAA Office of Aviation Policy and Plans, April 2000.
[24] GRA, Inc. "Review of TAF Methods," Final Report, prepared for FAA Office of Aviation Policy and Plans under Work Order 45, Contract No. DTFA01-93-C-00066, February 25, 1998.
[25] The mean absolute difference between the model operations estimate and the state operations estimate was 16,940 operations.
[26] Stolport is an airport designed with STOL (Short Take-Off and Landing) operations in mind, normally having a short single runway.
[27] As explained in footnote 6, an aircraft operation is defined as any landing or takeoff event, therefore, to calculate LTOs, operations are divided by two. The 5010 airport data report from FAA reports aircraft activity in numbers of operations which, for the purposes of calculating Pb emissions using the method described in the TSD, are converted to LTO events.

did not have based aircraft data.[28] Therefore, as described below, LTO estimates were derived using different methods depending on data availability.

Table 1: Contingency table describing the numbers of non-heliport facilities that have or do not have LTO data and/or based aircraft data for facilities in the February 7, 2012 version of the 5010 airport data report

HAVE BASED AIRCRAFT DATA	HAVE LTO DATA: YES	HAVE LTO DATA: NO	
YES	4,807	6,314	**11,121**
NO	728	2,216	**2,944**
	5,535	**8,530**	**14,065**

(a) Estimating LTOs at Facilities with Based Aircraft Data, but No LTO Data:

There are 6,289 facilities in the draft 2011 NEI (not including heliports) for which the 5010 airport data report supplies the number of based aircraft[29] but not activity data to which the regression equation (based aircraft vs. LTOs) could be applied.[30] Using the 4,807 airports for which both LTO and aircraft data is known, the initial relationship found between based aircraft and LTOs was:

Equation 1:

LTOs = 2956 + 166*aircraft $R^2 = 0.52$

[28] These numbers include data for the following types of facilities: airports, balloonports, seaplane bases, gliderports, heliports, stolports, and ultralights.
[29] Based aircraft for this purpose was limited to single- and multi-engine aircraft, helicopters, gliders, and ultralights since these aircraft types can use leaded avgas.
[30] There are 100 facilities in the NPIAS report that have both 0 GA and 0 AT operations; however, EPA did not estimate operations for these 100 facilities. 25 of the 100 facilities have based aircraft data, hence the difference between the 6,314 value in Table 1 and the 6,289 value stated in this sentence.

The FAA models found population to be another significant regressor. We used the population of the county in which the airport is located as the population variable. Adding county population to the model gave the following relationship:

Equation 2:

LTOs = 2706 + 156*aircraft + 0.0025*county population $R^2 = 0.53$

EPA received numerous comments to the docket on its Advance Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline[31] indicating that aviation in Alaska is different than it is in the continental U.S. Commenters pointed out that in Alaska, 82% of communities are not accessible by road and rely on air transport for life sustaining goods and services.[32] Commenters also noted that Alaskans travel by air eight times more often per capita than those in the continental U.S. For those reasons, we added a dummy variable in equation 3 to identify whether or not an airport is located in Alaska. Because the relationship between based aircraft and LTOs is likely different for Alaskan airports than it is for airports that aren't in Alaska, we also added an interaction term to equation 3 (interaction of an airport being in Alaska and its sum of based aircraft).

Equation 3:

LTOs = 2472 + 167*aircraft + 0.0022*county population - 162*Alaska – 98*(AlaskaXaircraft)
$R^2 = 0.55$

After analyzing the data and plot for the data underlying equation 3, we found many airport facilities identified as commercial airports for which based aircraft was extremely low (i.e., less than 10), yet LTOs were quite high (i.e., anywhere from 100,000 to more than 200,000 LTOs/year).[33] These facilities were removed from the regression analysis. Additionally, for reasons described below, heliports were also removed from the regression. The resulting relationship was:

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[31] U.S. Environmental Protection Agency (2010) Advance Notice of Proposed Rulemaking on Lead Emissions From Piston-Engine Aircraft Using Leaded Aviation Gasoline. 75 FR 22440 (April 28, 2010).

[32] Comments to the docket on EPA's Advance Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline from the Alaska Air Carriers Association (dated 18 June 2010; comment number OAR-2007-0294-0323.1) and Alaska Governor Parnell (dated 25 August 2010; comment number OAR-2007-0294-0403.1).

[33] From FAA's website, "Addresses for Commercial Service Airports", available at: http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/addresses/media/commercial_service_airports_addresses.xls

Equation 4:

$$LTOs = 1974 + 168*aircraft + 0.0009*county\ population - 1181*Alaska - 125*(AlaskaXaircraft)$$

$$R^2 = 0.63$$

When equation 4 was applied to the 6,289 airport facilities that report based aircraft data but not LTO activity, the resulting sum of LTOs was almost 8 million. EPA estimates that the number of LTOs at the airports that do not report activity data should approximate the number of LTOs from the bottom of the distribution of the set of airports that report activity data to the 5010 airport data report but that are not in the TAF database. The average number of GA LTOs per year from airports in the bottom 30% of the set of airports that report activity data to the 5010 airport data report but that are not in the TAF database is ~82 LTOs/year. Multiplying 82 by the number of airports that do not report activity data equals 687,045 LTOs.[34] Therefore, EPA used equation 4 to generate the distribution of LTOs at the individual airports that report based aircraft data but not activity data and then applied a scaling factor of 0.08 to those LTOs to obtain the LTOs that are reported in the draft 2011 NEI.[35] The sum of the LTOs from this set of airports plus the sum of the LTOs at the airports that do not report either based aircraft or activity data (described below in section *(b)*) sum to 687,045 LTOs. These LTOs are all assigned to the GA, piston-engine category since they are assigned to smaller general aviation airports that are assumed to have little to no air taxi or jet aircraft activity.

Equation 4 and the scaling factor were used to estimate LTO activity for the draft 2011 NEI at the 6,289 airport facilities that report based aircraft data but not activity data.

(b) Estimating LTOs at Facilities with Neither Based-Aircraft Data nor LTO Data:

There are 2,141 facilities (not including heliports) for which the 5010 airport data report supplies neither the number of based aircraft nor activity data. EPA investigated 100 of these facilities using on-line searches and Google Earth satellite images to ascertain whether these facilities exist and if so, whether aircraft activity appeared to be occurring. Because the majority of these facilities appeared to be active, we elected to assign 1 LTO to each facility. If EPA receives better data from state or local authorities, we will replace these estimates.

[34] This number is calculated by multiplying 81.5 LTOs/year by 8,430, which is the number of airports that don't report activity data (6,289 don't report activity data and 2,141 facilities don't report activity or based aircraft data).

[35] The scaling factor was calculated by dividing 684,904 LTOs by 8,608,829 LTOS; the 684,904 LTOs are equal to 687,045 LTOs minus 2,141 LTOs (2,141 LTOs represent the sum of LTOs assigned to the 2,141 facilities that don't report either activity data or based aircraft data - the derivation of LTO estimates for these facilities is described in Section 3 *(b)*). The 8,608,829 LTOs are the sum of LTOs that result from applying equation 4 to the 6,289 facilities with based aircraft data but no activity data.

Section 4. Calculating LTOs at Heliports:

There were 5,649 heliport facilities in the February 7, 2012 FAA 5010 data report that were operational. Of those, only 92 (or 2%) reported LTO data, and of those, only 29 reported both based aircraft and LTO data. Because of the limited information regarding activity at heliports, some municipalities have hired contractors to survey activity in their local area.[36, 37]

The summary statistics for LTO data provided at the 92 operational heliports is presented in Table 2. These facilities report a wide range in activity from 1 LTO/year to more than 18,000 LTOs/year. Some facilities clearly have significant helicopter traffic (i.e., thousands of LTOs/year) which is supported by the contractor summaries of heliport activity in the Washington Metropolitan area. The little data available to us suggests that the median helicopter activity is less than 200 LTOs/year. In the absence of more information on which to base estimates of LTO activity, we assigned 51 LTOs (the median of the reported heliport LTOs) to the GA category at all of the heliports which do not report LTO data. The piston-engine fraction developed in Section 5 is applied to the 51 LTOs resulting in 18 LTOs assigned to the GA, piston-engine category and 33 assigned to the GA, turbine-engine category. This is an area of significant uncertainty in the inventory and one for which EPA is seeking information from local agencies.

Table 2: Heliport LTO Data for those Reporting LTO Data in the February 7, 2012 Version of the 5010 Airport Data Report

18,200	Maximum GA LTOs
1	Minimum GA LTOs
793	Average GA LTOs
51	Median GA LTOs
50	Mode GA LTOs

Section 5. Calculating Piston-Engine LTO

Piston-engine LTOs are used to calculate emissions of lead that are assigned to the airport facility where the aircraft operations occur. An aircraft operation is defined as any landing or takeoff event, therefore, to calculate LTOs, operations are divided by two. Most data sources from FAA report aircraft activity in numbers of operations which, for the purposes of calculating lead emissions, need to be

[36] Executive Summary: Regional Helicopter System Plan, Metropolitan Washington Area, prepared by Edwards and Kelcey for the Metropolitan Washington Council of Governments, 2005.
[37] Alaska Aviation Emission Inventory, prepared by Sierra Research, Inc. for Western Regional Air Partnership, 2005.

converted to LTO events. We describe here the method used to estimate the fraction of GA and AT LTOs at an airport that are conducted by piston-engine aircraft. These fractions are calculated separately (one fraction for GA and one for AT). These fractions are multiplied by total LTOs reported separately for GA and AT and then summed to arrive at the total LTOs conducted by piston-engine aircraft at an airport.

One use of the draft 2011 NEI is to identify airports that have inventories of 0.50 tons per year or more since this is one of the criteria for identifying airports where lead monitoring may need to be considered to evaluate compliance with the National Ambient Air Quality Standard for Lead. To calculate the most airport-specific inventories for airports that may potentially exceed 0.50 tons per year, we used a more airport-specific surrogate for this subset of airports than the remainder of the airports where we applied national default averages described below.

We used the fraction of based aircraft at an airport that are single- or multi-engine to calculate the number of GA LTOs at an airport that were conducted by piston-engine aircraft. The data regarding the population of based aircraft at an airport is available for a subset of airports in the FAA 5010 master records data report described in Section 3. For example, if an airport reports 150 single-engine aircraft, 20 multi-engine aircraft and a total of 180 aircraft based at that facility, then the fraction of based aircraft we would use as a surrogate for piston-engine aircraft is 94% ((150+20)/180). We then multiply the total GA LTOs for that facility by 0.94 to calculate piston-engine GA LTOs.

We evaluated this surrogate by comparing the results of using it with piston-engine aircraft operations reported for airports that supply this information in master plans, airport layout plans, noise abatement studies and/or land use compatibility plans. We could rarely find data from the same year for comparison purposes; however, for the majority of airports, based aircraft and actual observed piston-engine aircraft activity agreed within ten percent.[38]

For the majority of airports in the draft 2011 NEI we used national average fractions of GA and AT LTOs conducted by piston-engine aircraft that were derived using FAA's General Aviation and Part 135[39] Activity Surveys – CY 2010 (GAATA).[40] Table 2.4 in the 2010 GAATA Survey reports that approximately sixty-six percent (66%) of all GA and AT LTOs are from piston-engine aircraft which use avgas, and about thirty-four percent (34%) are turboprop and turbojet powered which use jet fuel, such as

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[38] Documents used to evaluate the use of based aircraft include the following:
Airport Master Plan Update Prescott Municipal Airport (Ernest A Love Field) (2009) Available at: *www.cityof**prescott**.net/_d/amp_tablecontents.pdf*
Gillespie field Airport Layout Plan Update Narrative Report (2005) Available at: *www.co.san-diego.ca.us/dpw/**airport**s/powerpoints/pdalp.pdf*
Land Use Compatibility Plan for the Grand Forks International Airport (2006) Available at: www.gfk**airport**.com/authority/pdf/**land_use**.pdf

McClellan-Palomar Land Use Compatibility Plan (Amended March 4, 2010) Available at: *www.ci.oceanside.ca.us/.../**McClellan-Palomar**_ALUCP_03-4-10_amendment.pdf*

[39] On-demand (air taxi) and commuter operations not covered by Part 121
[40] The FAA GAATA is a database collected from surveys of pilots flying aircraft used for general aviation and air taxi activity. For more information on the 2010 GAATA, see Appendix A at http://www.faa.gov/data_research/aviation_data_statistics/general_aviation/CY2010/

Jet A. The LTO data in Table 2.4 in the 2010 GAATA Survey does not distinguish LTOs as GA or AT, and thus does not allow us derive separate piston-engine activity fractions for GA and AT.

We are using the number of hours flown by piston versus turboprop or turbojet aircraft (reported in Table 1.4 in the 2010 GAATA Survey) to allow us to make separate estimates of the fraction of GA activity conducted by piston aircraft and the fraction of AT activity conducted by piston aircraft. We chose to use the fraction of hours flown by piston-engine aircraft as a surrogate to calculate the fraction of LTOs flown by piston aircraft since the overall (i.e., for GA and AT combined) piston percent of hours flown (65.8%) is very close to the percent of LTOs that are piston (65.7%). Table 1.4 of the 2010 GAATA presents the total hours flown by aircraft type and separates GA from AT. Seventy-two percent (72%) of all GA hours flown are by piston-engine aircraft while twenty-eight percent (28%) of all GA hours flown are by turboprop and turbojet powered aircraft.[41] Twenty-two percent (22%) of all AT hours flown are by piston-engine aircraft while seventy-eight percent (78%) of all AT hours flown are by turboprop and turbojet powered aircraft. Approximately 5,000 of the total 20,000 airport facilities in the U.S. are heliports at which only helicopters (rotocraft) operate. Therefore, EPA also calculated the percent of rotocraft hours flown that are conducted by piston-engine aircraft. Thirty-six percent (36%) of all GA rotocraft hours flown are by piston-engine rotocraft while sixty-four percent (64%) of all GA rotocraft hours flown are by turboprop and turbojet powered rotocraft. Two percent (2%) of all AT rotocraft hours flown are by piston-engine rotocraft while ninety-eight percent (98%) of all AT rotocraft hours flown are by turboprop and turbojet powered rotocraft. Table 3 identifies the piston and turbine fractions that were used in the absence of airport-specific information to calculate piston-engine operations at airports and heliports in the draft 2011 NEI.

Table 3: Piston and Turbine Activity Fractions used in the draft 2011 NEI

	Airports		**Heliports**	
	GA	**AT**	**GA**	**AT**
Piston Powered	72.1%	21.8%	35.8%	2%
Turbine Powered	27.9%	78.2%	64.2%	98%

For additional information or if you have questions regarding the methods described in this document, please contact Meredith Pedde (pedde.meredith@epa.gov) or Marion Hoyer (hoyer.marion@epa.gov).

[41] Numbers in the text may not add to 100% due to rounding; the percentages in Table 3 are the values we used to calculate the draft 2011 NEI.

Attachment A

Table A-1: Scaling factors

Year	U.S. Product Supplied of Aviation Gasoline	Ratio of 2011 to
Before 1981[43]		0.55
1981	11,147	0.48
1982	9,307	0.58
1983	9,444	0.57
1984	8,692	0.62
1985	9,969	0.54
1986	11,673	0.46
1987	9,041	0.59
1988	9,705	0.55
1989	9,427	0.57
1990	8,910	0.60
1991	8,265	0.65
1992	8,133	0.66
1993	7,606	0.70
1994	7,555	0.71
1995	7,841	0.68
1996	7,400	0.72
1997	7,864	0.68
1998	7,032	0.76
1999	7,760	0.69
2000	7,188	0.75
2001	6,921	0.77
2002	6,682	0.80
2003	5,987	0.90
2004	6,189	0.87
2005	7,006	0.77
2006	6,626	0.81
2007	6,258	0.86
2008	5,603	0.96
2009	5,261	1.02
2010	5,358	1.00
2011	5,362	1.00

[42] Data from the Energy Information Administration's (EIA's) table, "U.S. Product Supplied of Aviation Gasoline (Thousand Barrels)." Available at: http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=mgaupus1&f=A Accessed March 28, 2012.

[43] EIA does not have data for volumes of avgas product supplied for years earlier than 1981. To calculate the scaling factor to use for activity data from years before 1981, we used the ratio of 2011 avgas volume product supplied to the average avgas volume supplied from 1981 to 1989.

Appendix B - Instructions for State Review

2011 Aircraft LTO Data Processing for the National Emission Inventory

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Purpose

To assist state, local, and tribal agencies in their submittal of aircraft-related activity data, EPA has compiled the aircraft landing and takeoff (LTO) data from several Federal Aviation Administration (FAA) data sources including the following: T-100 dataset, Terminal Area Forecast (TAF) data, Air Traffic Activity Data Systems (ATADS) data, and Airport Master Record (form 5010) data. These data are available for review and revision by agencies in order to accurately estimate activity data for all aircraft types. These compiled data, including local revisions, will be used to calculate the 2011 National Emission Inventory (NEI) aviation emissions.

Please note that by reviewing and correcting the LTO data in this dataset you will NOT need to submit an airport emissions file to EIS. If you send the revisions back to EPA now, EPA will perform the processing tasks required, such as matching EIS facility, unit, and process IDs for the airports, as well submitting the emissions inventory to the EIS Gateway. This will be the easiest way for agencies to submit local data into EIS; those who choose not to participate in this data gathering process, but still want local emissions data included in EIS, will be required to prepare their data to meet all EIS input requirements and submit it themselves.

Background

The T-100 data is derived from commercial aviation operations, reported directly by the airlines and specifically includes very detailed information about large commercial air carriers and air taxis. Because the T-100 aircraft data are provided for individual aircraft specifying manufacturer and aircraft model, they can be matched to specific aircraft in the FAA's Emission Dispersion and Modeling Systems (EDMS) which is a computer tool used to estimate emissions. Because of the details provided in T-100, it is also possible to identify which aircraft are typically used for air taxi services based on typical passenger capacity. All non-air taxi data in the T-100 data are assumed to be larger commercial aircraft.

The FAA's TAF and ATADS datasets do not provide operations data at the aircraft manufacturer and model level of detail that the T-100 data does; instead, operations are provided for general aircraft types (i.e., air carriers, air taxis, general aviation and military). ATADS includes actual operations at FAA controlled facilities, while TAF includes the ATADS data and also modeled operations for other non-FAA control facilities. Note that the TAF and ATADS data are provided as operations (separate operation counts for each landing and takeoff leg), such that the TAF and ATADS operations need to be divided by 2 to get LTOs.

Because both the T-100 data and the TAF/ATADS data reported by the airports include commercial air carriers and air taxis, the data needs to be adjusted to avoid issues of double counting when the two datasets are combined. This adjustment is done by summing up the air taxi and large commercial aircraft LTOs reported in the T-100 data for each airport and comparing these values to the commercial and air taxi data from TAF and ATADS at the same airport. Priority is given to maintaining T-100 data due to its higher specificity as follows:

- If the TAF/ATADS LTO value is greater than the T-100 value for a specific aircraft type and airport, then the T-100 value was subtracted from the TAF/ATADS value. e.g., T-100 reports 1000 LTO for Airport1, whereas TAF reports 2000. The database will include 1000 LTO from T-100 and 1000 LTO from TAF.
- If the T-100 value was greater than or equal to the TAF value, then the TAF value was set to zero. e.g., T-100 reports 2000 LTO for Airport2 and TAF reports 1000. The database will include 2000 LTO from T-100 and 0 from TAF.

The 5010 forms used for airport infrastructure planning include a variety of information about airport operations and characteristics. Such information is particularly important for smaller facilities where data sources are sparse. EPA reviewed the data reported in the 5010 submittals to estimate LTO activity for general aviation and air taxis. These data were compared to the TAF/ATADS data and adjusted for double counting using a similar approach to that used to adjust the T-100 and TAF/ATADS data. The TAF/ATADS data was considered to be of higher quality than the 5010 data and was given priority in the adjustment, as the T-100 was prioritized in the T-100 with TAF/ATADS adjustment.

Reviewing/Revising Data

EPA's compiled LTO data are available for state/local/tribal (SLT) agency review. The data are presented as a Microsoft Access database. The database includes two drop-down menus: one for selecting data by state and one for selecting data by tribal code. Once the state/tribe has been selected, users have the option of viewing the data in Access (this is a Read-Only and for review ONLY) or exporting the data to a Microsoft Excel spreadsheet for further review and revisions.

Please note that to export the data to Excel, the user will first need to create a folder on the C drive of their computer called "2011 NEI LTO Review" (C:\2011 NEI LTO Review). The exported Excel file(s) will be generated in this folder. Revisions should be made in the Excel file as described below to facilitate EPA processing and avoid errors:

- Revising Data: Existing LTO data can be corrected by adding the new data value to the "Revised LTO" column and marking it as a "Revision" in the "Revisions Comment" field.

- Removing Data: Please do not delete any rows in the Excel spreadsheet. If you want to remove LTO data, simply change the ”Revised LTO” column to 0 and mark it as a “Revision” in the “Revisions Comment” field.

- Adding Data: Rows can be added to account for new aircraft or engine type combination. Please make sure that the airport, aircraft, and engine combination does not already exist in the dataset before adding new rows, as adding an existing combination may cause double counting. When adding a row, fill in all other fields when possible, including the EISFacilitySiteIdentifier where possible. Also, you may leave the “PrimaryKey” and the “EPA LTO” fields blank, as these fields are for internal record keeping.

- EPA will assume a default taxi in time of 7 minutes and a default taxi out time of 19 minutes. If states want to revise the taxi in or out time for specific airports please add the correct times in revised taxi in time and revised taxi out time columns.

- Please note there are some airports in the dataset with limited information pertaining to the airport name, county FIPs, and addresses. This is indicated by the word “Placeholder:” at the beginning of the airport name. Please add additional information if possible.

See Figures 1, 2, 3, and 4 for examples on how to correctly submit these revisions. Please note that some EIS-required fields (i.e., EISEmissionsUnitIdentifier and EISEmissionsProcessIdentifier) are not included in the database. These fields were removed to simplify the data revision process and will be added by EPA. The EISFacilitySiteIdentifier, which is unique, is included, however, to avoid errors resulting from duplication of the more common three digit alphanumeric airport code, FacilitySiteIdentifier. (Note that the FacilitySiteIdentifier indicated may be one of many alternate ones for a given airport). Some airports in the database currently do not have an EISFacilitySiteIdentifier; EPA will add these during processing. If your airport is not included in this database (either with or without an EISFacilitySiteIdentifier) please add the airport and be prepared to provide the airport’s street address, city, state, zip, and latitude/longitude coordinates. If the airport had “Placeholder:” at the beginning of the airport name please also provide the airport’s street address, city, state, zip, and latitude/longitude coordinates.

The AircraftEngineTypeCodes are available under the Reporting Code Tables link in the EIS gateway.

Submitting Data to EPA

States must submit their changes by October 15 to this email address managed by EPA’s contractor Eastern Research Group (ERG): NEI-2011LTO@ERG.com. If no changes are

required, you may indicate that you accept EPA's estimates via an EIS support request (as you would for any category of data for which you accept EPA estimates), or by sending an email indicating acceptance to the above address. Note this email account has a 10 MB limit. If a state submittal is larger than 10 MB, a message can be left at this e-mail address requesting data transfer using a secure FTP site. A representative from ERG will respond to this request with instructions how to access the FTP site.

EPA will review the state-submitted data to ensure that it is appropriate and reasonable. Once the LTO data have been finalized, then the aircraft specific LTO data will be run using the latest version of EDMS to estimate criteria and HAP emissions for aircraft engine exhaust, auxiliary power units, and ground support equipment. The remaining aircraft type data will be applied to generic emission factors.

If you need assistance, contact Laurel Driver at 919.541.2859 or driver.laurel@epa.gov.

Note EPA strongly encourages agencies to review and, if necessary, submit their LTO data to the EPA via this review process. In doing so, then states need not submit EIS staging tables for the 2011 NEI.

Figure 1. Exported Data from Access Database for Review (no changes)

Primary Key	State And County FIPS Code	Tribal Code	Airport	City	State	FacilitySite Identifier	EISFacility Site Identifier	Source Classification Code	Process Description	Aircraft Engine TypeCode	EPA_ LTO	Revised_ LTO	Revised_ Taxi_In_ (default_7_min)	Revised_ Taxi_Out_ (default_19_min)	Revision Comment
1	37001		Example Airport	Durham	NC	AAA	10000000	2275050011	Aircraft /General Aviation /Piston	999903	100				
2	37001		Example Airport	Durham	NC	AAA	10000000	2275020000	Aircraft/Commercial	1412	150				

Figure 2. Example of a revision to an existing record

Primary Key	State And County FIPS Code	Tribal Code	Airport	City	State	FacilitySite Identifier	EISFacility Site Identifier	Source Classification Code	Process Description	Aircraft Engine TypeCode	EPA_ LTO	Revised_ LTO	Revised_ Taxi_In_ (default_7_min)	Revised_ Taxi_Out_ (default_19_min)	Revision Comment
1	37001		Example Airport	Durham	NC	AAA	10000000	2275050011	Aircraft /General Aviation /Piston	999903	100	82		12	Revision

Figure 3. Example of a deletion of an existing record

Primary Key	State And County FIPS Code	Tribal Code	Airport	City	State	FacilitySite Identifier	EISFacility Site Identifier	Source Classification Code	Process Description	Aircraft Engine TypeCode	EPA_ LTO	Revised_ LTO	Revised_ Taxi_In_ (default_7_min)	Revised_ Taxi_Out_ (default_19_min)	Revision Comment
2	37001		Example Airport	Durham	NC	AAA	10000000	2275020000	Aircraft/Commercial	1412	150	0			Revision

Figure 4. Example of additions to the existing dataset

Primary Key	StateAnd County FIPSCode	Tribal Code	Airport	City	State	FacilitySite Identifier	EISFacility Site Identifier	Source Classification Code	Process Description	Aircraft Engine TypeCode	EPA_ LTO	Revised_ LTO	Revised_ Taxi_In_ (default_7_min)	Revised_ Taxi_Out_ (default_19_min)	Revision Comment
	37001		Example Airport	Durham	NC	AAA	10000000	2275050011	Aircraft /General Aviation /Piston	1415		25		12	Addition
	37001		Example Airport2	Durham	NC	AAB	10000001	2275020000	Aircraft/Commercial	1418		30	5		Addition

Appendix C – State LTO Data

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
06111	NTD	9828811	Point Mugu Nas (Naval B	2275050012	999904				
06111	OXR	9828711	Oxnard	2275060011	1516	5230.0024			
06111	CMA	9829311	Camarillo	2275060012	1544	6.37			
06111	CMA	9829311	Camarillo	2275060012	1539	19.11			
06111	CMA	9829311	Camarillo	2275060012	2108	147.42			
06111	CMA	9829311	Camarillo	2275060011	2063	1396.096			
06111	CMA	9829311	Camarillo	2275060012	2099	6.37			
06111	CMA	9829311	Camarillo	2275060012	1549	6.37			
06111	CMA	9829311	Camarillo	2275060012	1590	147.42			
06111	CMA	9829311	Camarillo	2275060012	2107	6.37			
06111	FQB	9829211	San Nicolas Island	2275050011	999903				
06111	FQB	9829211	San Nicolas Island	2275050012	999904				
06111	CMA	9829311	Camarillo	2275060012	1447	6.37			
06111	NTD	9828811	Point Mugu Nas (Naval B	2275020000	676	1			
06111	CMA	9829311	Camarillo	2275050012	1454	6.37			
06111	OXR	9828711	Oxnard	2275060011	1514	6276.4119			
06111	OXR	9828711	Oxnard	2275060011	1515	1046.4095			
06111	OXR	9828711	Oxnard	2275060011	1520	627.164			
06111	OXR	9828711	Oxnard	2275020000	1876	3.4085			
06111	OXR	9828711	Oxnard	2275060011	1511	313.582			
06111	OXR	9828711	Oxnard	2275060011	2063	877.3479			
06111	OXR	9828711	Oxnard	2275060011	1568	313.582			
06111	OXR	9828711	Oxnard	2275060011	1567	313.582			
06111	OXR	9828711	Oxnard	2275060011	1528	438.3331			
06111	OXR	9828711	Oxnard	2275060011	1525	438.3331			
06111	OXR	9828711	Oxnard	2275060011	1628	313.582			
06111	OXR	9828711	Oxnard	2275060011	1513	5230.0024			

Appendix C – State LTO Data

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
06111	NTD	9828811	Point Mugu Nas (Naval B	2275050011	999903				
06111	CMA	9829311	Camarillo	2275060011	1568	797.889			
06111	CMA	9829311	Camarillo	2275060011	1628	797.889			
06111	CMA	9829311	Camarillo	2275060011	1520	1595.778			
06111	CMA	9829311	Camarillo	2275020000	1870	6.37			
06111	CMA	9829311	Camarillo	2275020000	1876	147.42			
06111	CMA	9829311	Camarillo	2275020000	1438	6.37			
06111	CMA	9829311	Camarillo	2275060011	1514	15943.517			
06111	CMA	9829311	Camarillo	2275060011	1515	2657.113			
06111	CMA	9829311	Camarillo	2275060011	1511	797.889			
06111	CMA	9829311	Camarillo	2275060011	1525	698.048			
06111	CMA	9829311	Camarillo	2275060012	1543	6.37			
06111	CMA	9829311	Camarillo	2275060011	2061	2393.667			
06111	CMA	9829311	Camarillo	2275060012	1435	6.37			
06111	CMA	9829311	Camarillo	2275060011	2048	1396.096			
06111	CMA	9829311	Camarillo	2275060012	2124	2054.78			
06111	CMA	9829311	Camarillo	2275060011	2066	1396.096			
06111	CMA	9829311	Camarillo	2275060011	2065	797.889			
06111	CMA	9829311	Camarillo	2275060011	1567	797.889			
06111	CMA	9829311	Camarillo	2275060011	1528	698.048			
06111	CMA	9829311	Camarillo	2275060012	1632	684.32			
06111	CMA	9829311	Camarillo	2275060011	1516	13286.404			
06111	CMA	9829311	Camarillo	2275060011	2067	1047.072			
06111	CMA	9829311	Camarillo	2275060011	2142	617.504			
06111	CMA	9829311	Camarillo	2275060012	1431	147.42			
06111	CMA	9829311	Camarillo	2275060011	2089	349.024			
06111	CMA	9829311	Camarillo	2275060012	1530	684.32			
06111	CMA	9829311	Camarillo	2275060012	1461	6.37			
06111	CMA	9829311	Camarillo	2275060011	1513	13286.404			

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
06111	6CL5	11661911	MAJLAR	2275050012	999904	105.79			
06111	CL73	12507011	ROTOR-AIDS MAINTENANCE HANGAR	2275050012	999904	105.79			
06111	CL34	12492611	FIRST INTERSTATE BANK	2275050012	999904	105.79			
06111	CL34	12492611	FIRST INTERSTATE BANK	2275050011	999903	35.29			
06111	2CL6	11994311	ST JOHN'S RGNL MEDICAL CENTER	2275050011	999903	35.29			
06111	2CL6	11994311	ST JOHN'S RGNL MEDICAL CENTER	2275050012	999904	105.79			
06111	53CA	11985211	HUMMINGBIRD NEST	2275050011	999903	35.29			
06111	53CA	11985211	HUMMINGBIRD NEST	2275050012	999904	105.79			
06111	3CL9	11924711	SCE NORTHERN DIVISION	2275050012	999904	105.79			
06111	3CL9	11924711	SCE NORTHERN DIVISION	2275050011	999903	35.29			
06111	82CA	11784711	SCE MOORPARK SUBSTATION	2275050011	999903	35.29			
06111	82CA	11784711	SCE MOORPARK SUBSTATION	2275050012	999904	105.79			
06111	96CL	11703311	TWI II	2275050012	999904	105.79			
06111	CL73	12507011	ROTOR-AIDS MAINTENANCE HANGAR	2275050011	999903	35.29			
06111	6CL5	11661911	MAJLAR	2275050011	999903	35.29			
06111	6CL3	11661711	WILLIAM SHELLS CO	2275050012	999904	105.79			

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
06111	6CL3	11661711	WILLIAM SHELLS CO	2275050011	999903	35.29			
06111	OXR	9828711	Oxnard	2275060011	2066	877.3479			
06111	6CA4	11661211	EAST VALLEY SHERIFF'S STATION	2275050012	999904	105.79			
06111	CMA	9829311	Camarillo	2275060012	543	1852.512			
06111	02CL	11548811	CONOVER AIR LODGE	2275050012	999904	0			
06111	02CL	11548811	CONOVER AIR LODGE	2275050011	999903	2084			
06111	1CA8	11522411	R I SCIENCE CENTER HELISTOP	2275050011	999903	35.29			
06111	1CA8	11522411	R I SCIENCE CENTER HELISTOP	2275050012	999904	105.79			
06111	1CA0	11492511	BOEING SANTA SUSANA	2275050012	999904	105.79			
06111	1CA0	11492511	BOEING SANTA SUSANA	2275050011	999903	35.29			
06111	CA72	11306711	COMMUNITY MEMORIAL HOSPITAL	2275050011	999903	35.29			
06111	CA72	11306711	COMMUNITY MEMORIAL HOSPITAL	2275050012	999904	105.79			
06111	96CL	11703311	TWI II	2275050011	999903	35.29			
06111	OXR	9828711	Oxnard	2275060012	543	888.9368			
06111	6CA4	11661211	EAST VALLEY SHERIFF'S STATION	2275050011	999903	35.29			
06111	CL82	12507911	LOS ROBLES RGNL MEDICAL CENTER	2275050012	999904	105.79			
06111	OXR	9828711	Oxnard	2275060011	2048	877.3479			

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
06111	OXR	9828711	Oxnard	2275060011	2065	313.582			
06111	OXR	9828711	Oxnard	2275060011	2067	657.8405			
06111	OXR	9828711	Oxnard	2275060011	2089	219.5074			
06111	OXR	9828711	Oxnard	2275060011	2142	296.5395			
06111	OXR	9828711	Oxnard	2275060012	1431	3.4085			
06111	OXR	9828711	Oxnard	2275060012	2124	41.5837			
06111	OXR	9828711	Oxnard	2275060011	2061	940.746			
06111	OXR	9828711	Oxnard	2275060012	1632	13.634			
06111	OXR	9828711	Oxnard	2275060012	1638	1817.4416			
06111	OXR	9828711	Oxnard	2275060012	1530	13.634			
06111	OXR	9828711	Oxnard	2275060012	1590	3.4085			
06111	SZP	9828611	Santa Paula	2275060011	2063	1489			
06111	CL82	12507911	LOS ROBLES RGNL MEDICAL CENTER	2275050011	999903	35.29			
06111	SZP	9828611	Santa Paula	2275060011	2142	80			
06111	SZP	9828611	Santa Paula	2275060011	1515	1489			
06111	OXR	9828711	Oxnard	2275060012	2108	3.4085			
06111	SZP	9828611	Santa Paula	2275060011	2060	1489			
06111	SZP	9828611	Santa Paula	2275060012	543	241			
06111	SZP	9828611	Santa Paula	2275060011	1512	1489			
06111	SZP	9828611	Santa Paula	2275060011	1513	2978			
06111	SZP	9828611	Santa Paula	2275060011	1511	5959			
06111	SZP	9828611	Santa Paula	2275060012	2124	161			
06111	SZP	9828611	Santa Paula	2275060011	1514	8937			
06111	SZP	9828611	Santa Paula	2275060011	2089	321			
09001	JSD	12395011	SIKORSKY	2275050012	999904	2893			Revision
09001	JSD	12395011	SIKORSKY	2275050011	999903	0			Revision
09001	CT56	11316511	50 WASHINGTON STREET	2275050011	999903	0			Revision
09001	CT83	12307211	DOW CHEMICAL	2275050012	999904	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
09001	CT83	12307211	DOW CHEMICAL	2275050011	999903	0			Revision
09001	CT76	11317011	CHASE MANHATTAN BANK OF CT	2275050012	999904	0			Revision
09001	CT76	11317011	CHASE MANHATTAN BANK OF CT	2275050011	999903	0			Revision
09001	5CT4	11847111	NORWALK HOSPITAL	2275050011	999903	0			Revision
09001	CT56	11316511	50 WASHINGTON STREET	2275050012	999904	0			Revision
09001	5CT4	11847111	NORWALK HOSPITAL	2275050012	999904	11			Revision
09001	0CT8	11517611	DANBURY HOSPITAL	2275050012	999904	31			Revision
09001	0CT8	11517611	DANBURY HOSPITAL	2275050011	999903	0			Revision
09001	0CT7	11014011	BRIDGEPORT HOSPITAL	2275050012	999904	32			Revision
09001	0CT7	11014011	BRIDGEPORT HOSPITAL	2275050011	999903	0			Revision
09001	CT12	11315111	MEDICAL CENTER	2275050011	999903	0			Revision
09001	CT12	11315111	MEDICAL CENTER	2275050012	999904	12			Revision
09003	CT38	11316011	CORPORATE CENTER	2275050012	999904	0			Revision
09003	CT20	12289911	RANKL FIELD	2275050011	999903	0			Revision
09003	CT23	11315711	DELLA	2275050011	999903	0			Revision
09003	CT23	11315711	DELLA	2275050012	999904	0			Revision
09003	CT28	12290411	VETERANS HOME & HOSPITAL	2275050011	999903	0			Revision
09003	CT17	11315511	UNITED TECHNOLOGY CORP.	2275050012	999904	0			Revision
09003	CT38	11316011	CORPORATE CENTER	2275050011	999903	0			Revision
09003	CT03	12289211	BRISTOL HOSPITAL	2275050011	999903	0			Revision
09003	CT75	12306811	HURLBRINK	2275050011	999903	0			Revision
09003	CT75	12306811	HURLBRINK	2275050012	999904	20			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
09003	CT28	12290411	VETERANS HOME & HOSPITAL	2275050012	999904	4			Revision
09003	CT17	11315511	UNITED TECHNOLOGY CORP.	2275050011	999903	0			Revision
09003	CT06	11314811	DELTA ONE	2275050012	999904	0			Revision
09003	CT03	12289211	BRISTOL HOSPITAL	2275050012	999904	12			Revision
09003	0CT9	11517711	HARTFORD HOSPITAL	2275050012	999904	1646			Revision
09003	0CT9	11517711	HARTFORD HOSPITAL	2275050011	999903	0			Revision
09003	0CT5	11517511	ST FRANCIS HOSPITAL	2275050012	999904	86			Revision
09003	0CT5	11517511	ST FRANCIS HOSPITAL	2275050011	999903	0			Revision
09003	0CT3	11013811	N B G H	2275050012	999904	7			Revision
09003	0CT3	11013811	N B G H	2275050011	999903	0			Revision
09003	CT06	11314811	DELTA ONE	2275050011	999903	0			Revision
09005	CT24	11315811	NORTH CANAAN AVIATION FACILITIES INC	2275050012	999904	260			Revision
09005	CT24	11315811	NORTH CANAAN AVIATION FACILITIES INC	2275050011	999903	1540			Revision
09005	0CT0	11517211	SHARON HOSPITAL	2275050012	999904	28			Revision
09005	0CT0	11517211	SHARON HOSPITAL	2275050011	999903	0			Revision
09007	CT97	12308611	SHORELINE CLINIC	2275050012	999904	37			Revision
09007	CT98	12308711	MIDDLESEX HOSPITAL	2275050011	999903	0			Revision
09007	CT97	12308611	SHORELINE CLINIC	2275050011	999903	0			Revision
09007	SNC	9790011	Chester	2275060012	999902	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
09007	SNC	9790011	Chester	2275060011	999901	0			Revision
09007	SNC	9790011	Chester	2275050012	999904	200			Revision
09007	SNC	9790011	Chester	2275050011	999903	2410			Revision
09007	CT98	12308711	MIDDLESEX HOSPITAL	2275050012	999904	30			Revision
09009	1CT2	11019011	YALE NEW HAVEN HOSPITAL	2275050012	999904	248			Revision
09009	CT95	12308411	MERIDEN-WALLINGFORD HOSPITAL	2275050012	999904	22			Revision
09009	CT95	12308411	MERIDEN-WALLINGFORD HOSPITAL	2275050011	999903	0			Revision
09009	CT77	12306911	AMERICAN CYANAMID CO	2275050012	999904	0			Revision
09009	CT77	12306911	AMERICAN CYANAMID CO	2275050011	999903	0			Revision
09009	CT25	12290211	MIRY DAM	2275050012	999904	0			Revision
09009	CT25	12290211	MIRY DAM	2275050011	999903	0			Revision
09009	CT21	12290011	C N FLAGG	2275050012	999904	0			Revision
09009	CT21	12290011	C N FLAGG	2275050011	999903	0			Revision
09009	1CT3	11019111	ST MARY'S	2275050011	999903	0			Revision
09009	1CT2	11019011	YALE NEW HAVEN HOSPITAL	2275050011	999903	0			Revision
09009	1CT3	11019111	ST MARY'S	2275050012	999904	19			Revision
09011	CT16	12289711	FETSKE	2275050011	999903	3			Revision
09011	CT93	12308211	BACKUS HOSPITAL	2275050011	999903	0			Revision
09011	CT93	12308211	BACKUS HOSPITAL	2275050012	999904	503			Revision
09013	CT53	12305611	MOUNTAIN VIEW	2275050011	999903	0			Revision
09013	CT53	12305611	MOUNTAIN VIEW	2275050012	999904	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
09015	0CT2	11517411	WINDHAM HOSPITAL	2275050011	999903	0			Revision
09015	0CT2	11517411	WINDHAM HOSPITAL	2275050012	999904	62			Revision
09015	CT69	11316811	NASIN	2275050011	999903	0			Revision
09015	CT69	11316811	NASIN	2275050012	999904	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	280	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1850	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1857	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	378	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	326	731	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	989	0			Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	263	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	2322	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	191	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1876	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1859	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	184	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1722	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1718	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1713	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1676	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1658	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1424	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	345	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	1572	0			Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	676	20805	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	999904	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	659	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	639	1095	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	631	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	620	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	582	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	573	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	476	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	450	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	430	365	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	407	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1575	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	1519	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275050011	999903	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	1623	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	2108	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275001000	999905	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	2182	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1412	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	722	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1881	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	751	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	827	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	861	59494	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	873	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	879	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	698	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275060011	999901	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	562	50368	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275060011	1513	365	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	1431	90151	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1428	365	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1425	51098	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1371	79932	11.5	21.7	Addition

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1363	2191	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	867	365	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	826	1460	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	772	730	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1077	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	581	730	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1684	3285	11.5	21.7	Addition

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	396	2191	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	307	11681	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	285	9490	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	135	730	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1341	730	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1263	365	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1187	1095	11.5	21.7	Addition

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1113	2192	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1034	11317	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	875	2920	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	661	28470	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	999902	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1400	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1395	1461	11.5	21.7	Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1378	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1364	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1336	367	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1295	13139	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1282	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1273	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1265	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1225	365	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	1605	730	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1145	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	1624	365	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1049	0			Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1518	2190	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275001000	1957	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275060012	2465	1460	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	2317	2192	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275050011	2095	365	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	2031	730	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1878	6205	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1694	1095	11.5	21.7	Addition
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1404	0			Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
13063	ATL	9748811	The William B Hartsfield International Airport	2275020000	1216	1095	11.5	21.7	Revision
13063	ATL	9748811	The William B Hartsfield International Airport	2275050012	1454	365	11.5	21.7	Addition
13153	5A2	11832911	WARNER ROBINS AIR PARK	2275050012	999904	1400			Revision
13153	5A2	11832911	WARNER ROBINS AIR PARK	2275050011	999903	3600			Revision
24001	1W3	11493011	MEXICO FARMS	2275050011	999903	907.92			Revision
24001	1W3	11493011	MEXICO FARMS	2275050012	999904	353.08			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	280	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1395	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1400	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1404	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1412	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1424	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1658	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1676	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	1713	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1718	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1722	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	184	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	326	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	191	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	631	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1378	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	676	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1295	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	659	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	639	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	345	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	378	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	453	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	476	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	582	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	601	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	620	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1876	0			Revision
24003	2MD7	12051211	MARITIME INSTITUTE	2275050011	999903	0	0	0	Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	2234	7.84			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	223	0.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2228	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2099	88.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2096	17.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2095	35.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2095	478.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2090	3.22			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2089	17.5			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275060011	2089	0.39			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2088	9.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2080	47.04			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1364	0			Revision
24003	0MD0	11530911	BALTIMORE WASHINGTON MEDICAL CENTER	2275050012	999904	0	0	0	Revision
24003	BWI	9571111	Baltimore-Washington In	2275050012	1529	1			Addition
24003	2MD7	12051211	MARITIME INSTITUTE	2275050012	999904	0	0	0	Revision
24003	BWI	9571111	Baltimore-Washington In	2275001000	1957	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275001000	999905	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1077	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1216	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1225	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1265	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1273	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1282	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	1286	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	827	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1336	0			Revision
24003	0MD0	11530911	BALTIMORE WASHINGTON MEDICAL CENTER	2275050011	999903	19	0	0	Revision
24003	BWI	9571111	Baltimore-Washington In	2275060011	1520	3			Addition
24003	W18	9570911	Suburban	2275050012	999904	3060			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060011	1512	233.64			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1512	5.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1512	3.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1516	83.16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1516	2.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1516	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1517	40.32			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1517	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1519	1.1			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275060012	1519	61.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1519	5834			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	698	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060011	1520	35.64			Addition
24003	MD81	12546911	SOUTH RIVER	2275050011	999903	2			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060011	1521	29.16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1521	1.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1522	3.6			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1524	8.64			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1524	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1525	26.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1525	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1525	3190.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1527	41.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1527	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1528	39.6			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275060011	1528	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1529	5.76			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1519	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1431	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	2247	39.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	849	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	861	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	873	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	879	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	989	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	999906	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275050011	999903	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275050012	1427	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275050012	1458	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275050012	1782	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275050012	1881	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275050012	999904	0			Revision
24003	W18	9570911	Suburban	2275050011	999903	7140			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1592	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	751	0			Revision
24003	MD43	12531911	MOUNTAIN ROAD	2275050011	999903	50			Revision
24003	MD22	12530711	DEALE	2275050011	999903	100			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	999902	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1642	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060011	1525	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1608	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060011	999901	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1590	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1557	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1553	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1519	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275060012	1479	0			Revision
24003	MD81	12546911	SOUTH RIVER	2275050012	999904	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275060012	1613	0			Revision
24003	BWI	9571111	Baltimore-Washington In	2275020000	1019	479			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2161	44837			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2179	3345			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	220	159			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	751	0.22			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2427	20			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	849	3.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	861	53.68			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	861	1.44			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	861	2187			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2431	6			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	925	53.57			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	925	1.08			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	2236	17.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1019	80.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	213	1167.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1077	2.42			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1077	9			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1145	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1216	51.59			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1216	1.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1257	18.37			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1264	27.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1269	0.77			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1269	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1276	0.55			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1286	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1295	827.5			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275050012	2068	5.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	925	11.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	515	4.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2	1.44			Addition
24003	BWI	9571111	Baltimore-Washington In	2275001000	2101	128.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275001000	2101	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	472	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275001000	482	26.64			Addition
24003	BWI	9571111	Baltimore-Washington In	2275001000	482	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	492	0.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	135	145.42			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	191	0.22			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	386	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	402	0.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	402	3042.5			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275020000	413	2618.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2161	10.44			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	685	13105			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1364	0.66			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	213	3.6			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2123	20540			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2123	2.16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2113	2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	45	673.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	703	2.64			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	487	2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2393	10.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	666	6.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2389	64.8			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	599	0.22			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275060012	543	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2141	2546			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	703	3.24			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2302	0.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1336	216.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1458	61.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1458	19.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1460	28.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1462	69.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1462	8.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1462	13			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1463	4.68			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1463	3739			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1471	368.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1479	2136.5			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275060012	2468	19.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1511	194.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1457	13.68			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2271	3.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1336	0.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2250	58.94			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2263	0.39			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2263	16.8			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	355	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2335	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	227	1.26			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2330	5.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2281	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	356	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2286	26.74			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275020000	229	0.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2290	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1454	5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2267	0.98			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1427	2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2241	9.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1364	1280.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1371	0.22			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1371	657			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1372	4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1385	2674.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1395	722.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1402	341.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1407	1.44			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1407	1011.5			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	1407	161.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1412	5.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1412	41			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1457	24			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1449	13.32			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1454	191.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1454	106.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1454	2.53			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1453	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1453	108			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1424	784.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1449	1.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1427	77.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1447	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1438	42.48			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275050012	1428	9			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1428	232.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1427	58.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1357	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1449	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1592	25.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1567	16.38			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1568	213.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1575	5.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1579	2.34			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1579	5.6			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1588	0.78			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2236	44.64			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1590	33.32			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1553	22.68			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	1622	0.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1628	8.26			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1631	3.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1631	8.54			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1638	0.78			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1638	16.38			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1588	32.34			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1539	3.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1521	11.34			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1522	1.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1524	3.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1525	10.22			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	1527	16.1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1528	15.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1557	51.66			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275060012	1530	8.54			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	249	34.02			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1541	6.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1542	52.64			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1747	0.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1561	45.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1544	0.14			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1549	109.62			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2389	25.2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1529	2.24			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2263	1.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1642	2.24			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	356	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2281	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2271	8.64			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	227	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	227	3.24			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	229	0.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	355	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2290	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2263	43.2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2263	0.11			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2250	16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2058	2.94			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2248	36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2241	24.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2236	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2267	2.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275001000	2101	50.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1519	3.9			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	599	0.78			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	402	0.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	191	0.78			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	135	515.58			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	492	0.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2286	68.76			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	472	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1676	0.14			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2	0.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2335	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2335	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2334	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2330	15.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2302	2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2302	1.44			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275001000	482	10.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	666	2.38			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	861	190.32			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1880	97.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1859	30.66			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1856	68.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1853	14.84			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1850	1.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1913	6.02			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	318	1.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1915	13.58			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2393	3.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	703	9.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	703	1.26			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2123	0.84			Addition

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275020000	213	1.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2161	4.06			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1520	13.86			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1849	8.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	346	76.3			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2059	35.7			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2062	0.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2063	85.68			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2064	5.04			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2065	42.7			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2066	8.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1881	2.24			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2056	0.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	861	0.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	346	7.8			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275050012	2051	0.98			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2032	29.26			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2030	2.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2020	1.96			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2009	0.14			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1916	67.9			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2057	3.64			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1462	27.02			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	751	0.78			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1449	5.18			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1453	42			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1454	8.97			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1454	41.58			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1457	5.32			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1428	90.44			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275050012	1460	10.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1427	30.1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1463	1.82			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2468	7.42			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1511	75.6			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1512	90.86			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1516	32.34			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1517	15.68			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2247	101.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1458	24.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1264	98.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1295	2.16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	925	189.93			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1530	21.96			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	925	0.42			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275020000	1019	285.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1077	8.58			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1438	16.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1257	65.13			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1519	24.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1269	2.73			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1276	1.95			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1295	0.84			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1336	3.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1364	2.34			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1371	0.78			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1407	0.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1216	182.91			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1686	239.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1859	78.84			Addition

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275060012	1592	65.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1622	0.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1628	21.24			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1631	0.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2250	151.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1638	0.22			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	2234	20.16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1638	5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1642	5.76			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1642	32.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1590	85.68			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1676	3724			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1588	78.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1713	1.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1722	1688			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275060012	1747	0.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	314	1.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	318	3.6			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1849	20.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1849	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1850	2.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1850	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1853	38.16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1853	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1856	177.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	1676	0.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1557	219.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1539	10.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1541	17.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1542	135.36			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275050012	1542	62			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1561	118.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1544	0.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1549	281.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1549	2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1549	635.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1553	58.32			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	249	87.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1590	2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1557	132.84			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	1638	42.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1567	42.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1567	2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1568	547.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	1568	8.5			Addition

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275050012	1575	15.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1575	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1579	0.66			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1579	14.4			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1581	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1588	0.22			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1588	83.16			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1588	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	249	169.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2062	0.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1880	251.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2058	7.56			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2059	91.8			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2065	109.8			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2065	6			Addition

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
24003	BWI	9571111	Baltimore-Washington In	2275060011	2066	20.88			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2066	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2068	15.12			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2080	120.96			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2056	0.72			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2088	24.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	346	196.2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2089	0.11			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2089	45			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2090	8.28			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2090	1			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2095	135.08			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2095	91.44			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2095	365			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2096	44.64			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275050012	1631	21.96			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2096	8			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2080	0.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2228	0			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1880	134.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1881	5.76			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1913	15.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1915	34.92			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1916	174.6			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	1916	150.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2009	0.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2020	5.04			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2030	6.48			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2057	9.36			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	223	1.44			Addition

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24003	BWI	9571111	Baltimore-Washington In	2275060012	2099	168.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2099	227.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2059	2.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2063	220.32			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060011	2063	5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275060012	2064	12.96			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2032	5.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2051	2.52			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050012	2051	208.5			Addition
24003	BWI	9571111	Baltimore-Washington In	2275020000	346	2.2			Addition
24003	BWI	9571111	Baltimore-Washington In	2275050011	2032	75.24			Addition
24005	MTN	9572011	Martin State	2275060011	999901	0			Revision
24005	MTN	9572011	Martin State	2275060012	1519	0			Revision
24005	MTN	9572011	Martin State	2275001000	999905	2726			Addition
24005	MTN	9572011	Martin State	2275050012	999904	29056			Addition
24005	MTN	9572011	Martin State	2275050011	999903	4507			Addition
24005	MTN	9572011	Martin State	2275020000	999906	906			Addition
24005	5MD6	11707711	FRANKLIN SQUARE HOSPITAL CENTER	2275050011	999903	0	0	0	Revision

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24005	5MD6	11707711	FRANKLIN SQUARE HOSPITAL CENTER	2275050012	999904	0	0	0	Revision
24005	MTN	9572011	Martin State	2275001000	999905	0			Revision
24005	MTN	9572011	Martin State	2275020000	999906	0			Revision
24005	MTN	9572011	Martin State	2275050011	999903	0			Revision
24005	MTN	9572011	Martin State	2275060012	1572	0			Revision
24005	MTN	9572011	Martin State	2275050012	999904	0			Revision
24005	MTN	9572011	Martin State	2275060012	2453	0			Revision
24005	MTN	9572011	Martin State	2275060012	999902	0			Revision
24011	8MD4	11654111	SPIERING	2275050011	999903	78			Revision
24013	07MD	11505811	BAUGHER'S ORCHARD	2275050011	999903	0			Revision
24015	6MD4	11235011	PEMBROKE FARM	2275050011	999903	28			Revision
24015	MD93	12547411	HEXTON FARMS	2275050011	999903	78			Revision
24017	MD06	12529811	PILOTS COVE	2275050011	999903	2			Revision
24017	MD55	11359611	HOLLY SPRINGS FARM	2275050011	999903	5			Revision
24019	3MD8	11132711	POKETY	2275050011	999903	2			Revision
24019	1MD1	11034211	BIG OAK FARM	2275050011	999903	18			Revision
24019	MD18	11358411	HORN POINT	2275050011	999903	100			Revision
24021	FDK	9569411	Frederick Muni	2275001000	999905	325			Addition
24021	FDK	9569411	Frederick Muni	2275050012	999904	7015			Addition
24021	FDK	9569411	Frederick Muni	2275050011	999903	55338			Addition
24021	FDK	9569411	Frederick Muni	2275020000	999906	2273			Addition
24021	FDK	9569411	Frederick Muni	2275001000	999905	0			Revision
24021	FDK	9569411	Frederick Muni	2275050011	999903	0			Revision
24021	FDK	9569411	Frederick Muni	2275050012	999904	0			Revision
24021	FDK	9569411	Frederick Muni	2275060011	999901	0			Revision
24021	FDK	9569411	Frederick Muni	2275060012	999902	0			Revision
24021	FDK	9569411	Frederick Muni	2275020000	999906	0			Revision

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24023	3MD2	11965711	GARRETT COUNTY MEMORIAL HOSPITAL	2275050012	999904	0	0	0	Revision
24023	3MD2	11965711	GARRETT COUNTY MEMORIAL HOSPITAL	2275050011	999903	39	0	0	Revision
24025	03MD	11557111	UPPER CHESAPEAKE MEDICAL CENTER	2275050012	999904	0	0	0	Revision
24025	0W3	9568311	Harford County	2275050011	999903	6428.641223			Revision
24025	0W3	9568311	Harford County	2275050012	999904	2491.358777			Revision
24025	4MD6	11167411	MOXLEY'S	2275050011	999903	58			Revision
24025	APG	12369011	PHILLIPS AAF	2275050011	999903	17503.34579			Revision
24025	EDG	12355911	WEIDE AHP (ABERDEEN PROVING GROUND)	2275050011	999903	410.6542056			Revision
24025	MD31	12531311	FOREST HILL	2275050011	999903	350			Revision
24025	W42	12141111	FALLSTON	2275050011	999903	3155.5825			Revision
24025	W42	12141111	FALLSTON	2275050012	999904	1222.9175			Revision
24025	03MD	11557111	UPPER CHESAPEAKE MEDICAL CENTER	2275050011	999903	105	0	0	Revision
24027	MD24	11358811	HAYSFIELD	2275050011	999903	500			Revision
24027	MD47	12532211	BARNES	2275050011	999903	150			Revision
24029	05MD	11566411	BREEZECROFT airport	2275050011	999903	30			Revision
24031	1MD7	11034411	SHADY GROVE ADVENTIST HOSPITAL	2275050011	999903	105	0	0	Revision
24031	5MD9	11720611	SUBURBAN	2275050011	999903	189	0	0	Revision

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24031	1MD7	11034411	SHADY GROVE ADVENTIST HOSPITAL	2275050012	999904	0	0	0	Revision
24031	5MD9	11720611	SUBURBAN	2275050012	999904	0	0	0	Revision
24033	ADW	9567311	Andrews AFB	2275020000	326	0			Revision
24033	3MD1	11965611	SOUTHERN MD HOSPITAL CENTER	2275050011	999903	265	0	0	Revision
24033	3MD1	11965611	SOUTHERN MD HOSPITAL CENTER	2275050012	999904	0	0	0	Revision
24033	ADW	9567311	Andrews AFB	2275001000	1957	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	999906	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	1676	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	280	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	659	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	676	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	861	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	879	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	989	0			Revision
24033	ADW	9567311	Andrews AFB	2275001000	999905	0			Revision
24033	ADW	9567311	Andrews AFB	2275060012	999902	0			Revision
24033	ADW	9567311	Andrews AFB	2275001000	999905	17207			Addition
24033	ADW	9567311	Andrews AFB	2275001000	999905	18862	0	0	Addition PLANES NOT COPTERS
24033	ADW	9567311	Andrews AFB	2275050011	999903	0			Revision
24033	ADW	9567311	Andrews AFB	2275020000	631	0			Revision
24033	ADW	9567311	Andrews AFB	2275050012	999904	0			Revision
24033	ADW	9567311	Andrews AFB	2275060011	999901	0			Revision
24035	0MD7	10977711	THE ASPEN INSTITUTE	2275050012	999904	0	0	0	Revision
24035	50MD	1	QUEEN ANNE E.R.	2275050011	999903	15	0	0	Revision

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24035	50MD	1	QUEEN ANNE E.R.	2275050012	999904	0	0	0	Revision
24035	MD19	11358511	HYBARC FARM	2275050011	999903	96			Revision
24035	0MD7	10977711	THE ASPEN INSTITUTE	2275050011	999903	1	0	0	Revision
24037	4MD4	11167211	CLEMENTS	2275050011	999903	5			Revision
24037	MD45	11359511	HAMPTON	2275050011	999903	52			Revision
24037	MD01	12529511	WINGFIELD	2275050011	999903	30			Revision
24037	8MD7	11654411	DEERFIELD	2275050011	999903	37			Revision
24037	7MD5	11257611	ST. MARY'S HOSPITAL	2275050012	999904	0	0	0	Revision
24037	7MD5	11257611	ST. MARY'S HOSPITAL	2275050011	999903	586	0	0	Revision
24039	5MD7	11207511	BLUEMEL FIELD	2275050011	999903	8			Revision
24041	MD29	12531111	MEMORIAL HOSPITAL	2275050011	999903	151	0	0	Revision
24041	MD29	12531111	MEMORIAL HOSPITAL	2275050012	999904	0	0	0	Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275050012	999904	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275020000	999906	1691			Addition
24043	HGR	9565811	Hagerstown Regional-Ric	2275060012	999902	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275060012	1572	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275060011	1525	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275050012	999904	8122			Addition

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24043	HGR	9565811	Hagerstown Regional-Ric	2275050011	999903	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275020000	999906	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275001000	999905	2416			Addition
24043	HGR	9565811	Hagerstown Regional-Ric	2275020000	1364	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275020000	1273	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275001000	999905	0			Revision
24043	22MD	11057311	LAURA'S LANDING	2275050011	999903	20			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275050011	999903	11932			Addition
24043	HGR	9565811	Hagerstown Regional-Ric	2275020000	676	0			Revision
24043	HGR	9565811	Hagerstown Regional-Ric	2275060011	999901	0			Revision
24510	MD10	12530111	BALTIMORE POLICE DEPARTMENT	2275050012	999904	0	0	0	Revision
24510	MD10	12530111	BALTIMORE POLICE DEPARTMENT	2275050011	999903	3019	0	0	Revision
24510	8MD3	11277011	SINAI II	2275050012	999904	0	0	0	Revision
24510	8MD3	11277011	SINAI II	2275050011	999903	37	0	0	Revision
24510	8MD2	11654011	MONTEBELLO FILTRATION PLANT	2275050011	999903	0	0	0	Revision
24510	8MD2	11654011	MONTEBELLO FILTRATION PLANT	2275050012	999904	0	0	0	Revision

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32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1877	122	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1892	48	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1876	224	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1356	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1888	18	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2355	8	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2356	108	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2357	182	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2376	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1513	5064	4.54	11.14	Addition

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32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1516	1890	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1517	2730	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1567	108	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1568	1846	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2032	794	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2057	902	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2059	1408	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2353	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	772	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2462	82	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2143	36	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2140	90	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2095	2180	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	543	78	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2063	224	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	623	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2065	754	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	867	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	949	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1034	4	4.54	11.14	Addition

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32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1253	10	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1253	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2351	10	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	548	14	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1788	362	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1872	56	4.54	11.14	Addition
32031	N86	12470811	Spanish Springs Airport	2275001000	548	10	2	2	Addition
32031	N86	12470811	Spanish Springs Airport	2275060012	543	10	2	2	Addition
32031	N86	12470811	Spanish Springs Airport	2275060011	1528	291	2	2	Addition
32031	N86	12470811	Spanish Springs Airport	2275060011	1516	884	2	2	Addition
32031	4SD	9373611	Reno/Stead Airport	2275001000	2212	3472	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275001000	1202	2968	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275060012	543	3048	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275050012	37	895	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275060011	2270	1099	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	4SD	9373611	Reno/Stead Airport	2275050012	2111	472	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275050012	1454	3452	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275060011	1521	3153	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2353	260	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1542	474	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2212	16	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2187	540	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1428	306	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1429	188	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1449	44	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275060011	1516	27745	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1538	4096	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1870	14	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1550	228	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1581	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1605	16	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1619	192	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1669	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	37	116	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1456	1426	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	861	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	280	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	326	0			Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	582	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	620	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	631	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	639	900			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	659	0			Revision
32031	4SD	9373611	Reno/Stead Airport	2275050012	999904	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	698	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1658	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	879	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	989	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	999906	2			Revision

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32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	999903	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1850	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	999904	200			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	999901	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	676	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1957	1588	4.54	11.14	Revision
32031	4SD	9373611	Reno/Stead Airport	2275001000	999905	0			Revision
32031	N86	12470811	Spanish Springs Airport	2275060011	1513	884	2	2	Addition
32031	4SD	9373611	Reno/Stead Airport	2275050011	999903	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1915	142	4.54	11.14	Addition
32031	N86	12470811	Spanish Springs Airport	2275050012	999904	0			Revision
32031	NV57	11405111	WASHOE MEDICAL CENTER	2275050011	999903	0			Revision
32031	NV57	11405111	WASHOE MEDICAL CENTER	2275050012	999904	0			Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	191	0			Revision
32031	NV78	12147411	REMSA/CARE FLIGHT	2275050012	999904	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	184	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	999905	8	4.54	11.14	Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1364	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1378	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1395	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1404	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1412	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1424	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1869	0			Revision

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32031	NV78	12147411	REMSA/CARE FLIGHT	2275050011	999903	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1624	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1479	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1449	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1456	246	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1538	844	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1542	36	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1550	278	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1581	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1428	110	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1619	68	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	543	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1638	10	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1669	2416	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1788	24	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1872	8	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1876	18	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1877	12	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1892	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1915	8	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1605	718	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1517	106	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2031	110	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2108	0			Revision
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	999902	62			Revision
32031	NV57	11405111	WASHOE MEDICAL CENTER	2275060011	2270	2132	4.54	11.14	Addition
32031	????	1	WASHOE County Sheriff's Heliport	2275060012	543	702	4.54	11.14	Addition
32031	NV58	12146911	ST MARY'S RGNL MEDICAL CENTER	2275060011	2270	228	4.54	11.14	Addition
32031	NV69	11405411	NORTHERN NEVADA MEDICAL CENTER	2275060011	2270	8	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1429	5276	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1516	148	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1615	0			Revision

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FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2032	14	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2059	8	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2063	606	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2095	58	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2140	68	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2143	18	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2462	20	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	37	26	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	1513	20	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1	58	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1538	132	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1456	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1449	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1316	20	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1311	68	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1300	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2244	854	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	37	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1742	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2376	2778	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2321	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2307	634	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2284	2550	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2280	17170	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2246	1312	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	543	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2140	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2031	230	4.54	11.14	Addition
32031	4SD	9373611	Reno/Stead Airport	2275001000	2102	230	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2462	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2215	50	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2212	78	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2202	78	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1550	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2143	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1563	18	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2059	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2045	44	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050011	2032	88	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1987	34	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	1970	48	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1888	48			Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	1605	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2172	16	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2208	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2355	62	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2354	816	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2353	418	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2351	904	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2069	44	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2307	2	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2356	56	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2212	14	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2325	10	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275001000	2202	12	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2187	96	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060012	2088	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2080	332	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2237	3234	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	1877	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2270	26	4.54	11.14	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1356	942	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1425	3396	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	2280	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1371	506	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275050012	2357	182	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1355	54	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1235	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	1033	40	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	925	4	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	867	1164	4.54	11.14	Addition

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32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	623	5436	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275060011	2454	148	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	623	5436	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	587	6	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	353	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	352	2	4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	135		4.54	11.14	Addition
32031	RNO	9376411	Reno/Tahoe International Airport	2275020000	61		4.54	11.14	Addition
33011	MHT	9369111	Manchester	2275050012	1462	46.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1529	2	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1541	159.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1542	67	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1554	32	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1460	2	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1577	68	4.5	12.16	Addition

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33011	MHT	9369111	Manchester	2275050012	1449	3	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1556	89.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1458	30	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2342	5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1429	260.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1453	14.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1587	45.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1446	1	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	37	4	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1427	14.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2340	42	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2030	6	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275001000	1833	40	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2149	15.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	1513	96	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2119	157.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2114	22.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2112	882.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2080	18.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	1511	14.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2051	64	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1588	15.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	2021	472.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1916	25.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1915	15.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1913	16.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1880	4	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1850	10.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1595	5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050012	1591	4	4.5	12.16	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
33011	MHT	9369111	Manchester	2275050012	2079	28	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	586	6.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2064	15.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1632	27	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1553	11.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1549	286.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1269	1	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1263	1	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1005	53.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275001000	2215	4	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	610	19.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1853	6	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	2239	7	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	144	16.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	635	82.5	3.84	10.31	Addition
33011	MHT	9369111	Manchester	2275060011	1516	68	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275001000	2105	390.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	1567	10.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275001000	1742	4	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	867	351.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	1524	3	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2095	63	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2090	14.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2062	2	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2058	24.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2057	13.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2056	2	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2032	118.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2099	112	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	1527	12.5	4.5	12.16	Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
33011	MHT	9369111	Manchester	2275060012	2208	2	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	1522	1	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1665	920	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1436	3.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	2163	2	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	2144	5.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1859	6	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1856	23.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275050011	2141	12.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	999902	0			Revision
33011	MHT	9369111	Manchester	2275020000	676	12.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275060011	999901	0			Revision
33011	MHT	9369111	Manchester	2275020000	191	0			Revision
33011	MHT	9369111	Manchester	2275020000	326	0			Revision
33011	MHT	9369111	Manchester	2275020000	601	0			Revision
33011	MHT	9369111	Manchester	2275020000	620	6320.5	3.84	10.31	Revision
33011	MHT	9369111	Manchester	2275020000	631	58.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1722	331.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	659	1761.5	3.84	10.31	Revision
33011	MHT	9369111	Manchester	2275020000	1718	0			Revision
33011	MHT	9369111	Manchester	2275020000	861	0			Revision
33011	MHT	9369111	Manchester	2275020000	989	0			Revision
33011	MHT	9369111	Manchester	2275020000	999906	0			Revision
33011	MHT	9369111	Manchester	2275050011	999903	0			Revision
33011	MHT	9369111	Manchester	2275050012	999904	0			Revision
33011	MHT	9369111	Manchester	2275060011	2381	0			Revision
33011	MHT	9369111	Manchester	2275020000	639	0			Revision
33011	MHT	9369111	Manchester	2275020000	1378	592.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275001000	999905	0			Revision
33011	MHT	9369111	Manchester	2275020000	1216	496	4.5	12.16	Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
33011	MHT	9369111	Manchester	2275020000	1225	0			Revision
33011	MHT	9369111	Manchester	2275020000	1265	0			Revision
33011	MHT	9369111	Manchester	2275020000	1273	0			Revision
33011	MHT	9369111	Manchester	2275060011	1525	59.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	184	744	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275060011	1517	15.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275020000	1364	2	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1400	893.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1404	0			Revision
33011	MHT	9369111	Manchester	2275020000	1412	1019	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1424	64.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1676	1886	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1713	2352.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1336	2	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275060011	2065	108	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1637	412	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1508	1	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2329	2311.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	11	1	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	2060	132	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	2147	16.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1639	9.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	2089	30	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	2066	24.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	1568	104	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	1528	53.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	1521	31	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060011	1520	29	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1519	1539.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275020000	1295	2	4.5	12.16	Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
33011	MHT	9369111	Manchester	2275060011	2096	158.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	543	3	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1543	61	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2182	0			Revision
33011	MHT	9369111	Manchester	2275060012	1613	4	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275060012	2085	324	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275060012	1642	384	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2453	294.5	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275060011	2063	29	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2180	1363	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2127	32	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2461	19.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	2094	2415.5	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1764	1	4.5	12.16	Addition
33011	MHT	9369111	Manchester	2275060012	1611	269	4.5	12.16	Revision
33011	MHT	9369111	Manchester	2275060012	1608	94	4.5	12.16	Revision
34013	EWR	9376211	Newark Liberty Intl	2275050012	1870	38.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1631	4			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1848	22.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1622	17.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	2180	1.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1849	22.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1602	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1850	86.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1878	209			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1880	1.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2020	5.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2030	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2051	37			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2052	74			airport supplied

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
34013	EWR	9376211	Newark Liberty Intl	2275050012	2064	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	285	3295			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	307	7334			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1447	153			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1449	12.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1428	193			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1453	23			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1454	81			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1457	8			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1458	64.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1549	106.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1519	2475.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1592	116			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2068	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1529	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1530	8			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1542	72			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1553	13			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1557	119			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1579	93.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1588	70.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1460	31			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	1643	24370			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	608	10.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	632	2364.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	764	520			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1052	2020			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	548	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	37	51.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	1572	2			airport supplied

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
34013	EWR	9376211	Newark Liberty Intl	2275060012	1613	20716			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	389	1201.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	516	2			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	2085	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	1609	8093			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	1773	24			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	2094	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	2125	56.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	2127	69.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1516	5.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1544	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2099	161			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2105	6			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2107	2			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2109	289			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2111	12			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2113	22.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2156	2.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	557	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1543	51.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	446	650.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1548	222.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1915	3.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1540	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1541	5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275060012	1642	50			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	359	1228.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2080	2			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	2208	31			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1071	5760.5			airport supplied

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
34013	EWR	9376211	Newark Liberty Intl	2275020000	2223	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	2163	13.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1875	299.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1872	33.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1711	16042			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1383	1570.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1371	1527.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1363	1275.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1335	2			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1284	21			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	999903	21			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1187	24			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1438	82.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	220	334			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	100	5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	2211	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	1742	12.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	1967	2			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	1957	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	1554	105			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	1427	76			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275001000	1199	4.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1520	4			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	18	70.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1269	10			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2095	23			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	8	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	6	7.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	999904	584.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050012	1782	14.5			airport supplied

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
34013	EWR	9376211	Newark Liberty Intl	2275050012	1575	7			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275020000	1376	8.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2140	3			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	36	3			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2066	8			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2065	12			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2063	37.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2062	1			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2059	6.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1525	7			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1513	14.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2148	3			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2057	2			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1517	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1522	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1527	8.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1528	3.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1568	23			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2032	3			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	2056	0.5			airport supplied
34013	EWR	9376211	Newark Liberty Intl	2275050011	1521	7			airport supplied
50021	1VT8	1	MORTIMER BROWN LANDING	2275060011	999901	0			addition - airport moved from out of state
50021	1VT8	1	MORTIMER BROWN LANDING	2275060012	999902	0			addition - airport moved from out of state
50021	1VT8	1	MORTIMER BROWN LANDING	2275050012	999904	0			addition - airport moved from out of state

Appendix C – State LTO Data

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
50021	1VT8	1	MORTIMER BROWN LANDING	2275050011	999903	100.78			addition - airport moved from out of state
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	1202	66			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	548	13			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	548	84			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275060012	2372	3			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	2212	585			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	2203	67			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	1957	2			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275060012	1490	20			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	1199	1			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275001000	488	20			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275060012	1519	6			Addition
51033	APH	12369111	A P HILL AAF (FORT A P HILL)	2275060012	2348	4			Addition
51059	DAA	12326211	DAVISON AAF	2275001000	548	188.5			Addition
51059	DAA	12326211	DAVISON AAF	2275001000	548	654.8			Addition
51059	DAA	12326211	DAVISON AAF	2275020000	2276	462.7			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51087	RIC	9070011	Richmond International	2275001000	2212	1617			Addition
51087	RIC	9070011	Richmond International	2275001000	2102	587			Addition
51087	RIC	9070011	Richmond International	2275020000	2276	727			Addition
51087	RIC	9070011	Richmond International	2275001000	548	1811			Addition
51087	RIC	9070011	Richmond International	2275001000	999905	0			Revision
51087	RIC	9070011	Allen C Perkinson/Baaf	2275001000	999905	13054			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060011	2462	1.19			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060012	2126	28.5			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	488	21.38			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	2211	9.5			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275050011	999903	79			Revision
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	544	16.63			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060012	999902				Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	548	33.25			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	548	41.57			Addition

Appendix C – State LTO Data

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060011	2270	16.63			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	2212	3896.52			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275020000	2276	11.87			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060012	1549	2.38			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	1199	213.77			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	1202	2403.71			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	1311	5.94			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	2209	3827.64			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060011	1516	13.06			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060012	1605	2.38			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	1957	34.44			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	2001	16.63			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275050012	2050	1.19			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060011	2061	8.31			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060011	2065	1.19			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275001000	2202	292.15			Addition
51179	NYG	11407811	QUANTICO MCAF /TURNER FIELD	2275060011	1514	17.81			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	1553	1			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	531	6			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275020000	2276	59			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060011	2270	9			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275001000	1202	24			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	1490	7			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	1519	1			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	1862	6			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275001000	1957	8			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	2123	6			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	2182	42			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	2196	1			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275001000	2212	336			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	2208	1			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	2348	52			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275060012	1611	1			Addition
51199	W94	12155911	CAMP PEARY LNDG STRIP	2275001000	2203	49			Addition
51550	NFE	12285211	FENTRESS NALF	2275001000	2212	377			Addition
51550	NFE	12285211	FENTRESS NALF	2275001000	1311	29724			Addition
51550	NFE	12285211	FENTRESS NALF	2275001000	1836	1505			Addition
51550	NFE	12285211	FENTRESS NALF	2275001000	1838	5644			Addition
51550	NFE	12285211	FENTRESS NALF	2275001000	1842	376			Addition
51550	NFE	12285211	FENTRESS NALF	2275001000	1957	2			Addition
51650	LFI	9077811	Langley AFB Airport	2275001000	1995	197			Addition
51650	LFI	9077811	Langley AFB Airport	2275001000	2215	517			Addition
51650	LFI	9077811	Langley AFB Airport	2275050011	999903	428			Revision
51650	LFI	9077811	Langley AFB Airport	2275001000	1988	2637			Addition
51700	FAF	12376911	FELKER AAF	2275060011	999901	698			Revision
51700	FAF	12376911	FELKER AAF	2275001000	548	225			Addition
51700	FAF	12376911	FELKER AAF	2275001000	548	5000			Addition
51700	FAF	12376911	FELKER AAF	2275020000	2276	250			Addition
51700	FAF	12376911	FELKER AAF	2275060011	2270	12500			Addition
51700	FAF	12376911	FELKER AAF	2275001000	2212	37500			Addition
51700	FAF	12376911	FELKER AAF	2275001000	2203	5000			Addition
51700	FAF	12376911	FELKER AAF	2275001000	1202	5000			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	1265	11			Revision
51710	NGU	9068911	Norfolk Ns	2275001000	1957	123			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	1842	6			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	1838	1268			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51710	NGU	9068911	Norfolk Ns	2275001000	1836	440			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	1819	9			Addition
51710	NGU	9068911	Norfolk Ns	2275060011	1567	18			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	1967	3			Addition
51710	NGU	9068911	Norfolk Ns	2275060011	1514	1			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	1988	56			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	1336	3			Revision
51710	NGU	9068911	Norfolk Ns	2275001000	1455	2			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	1363	17			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	1356	4			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	1311	174			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	1279	7			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	1200	2			Addition
51710	NGU	9068911	Norfolk Ns	2275050012	1550	4			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	488	18			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	936	10			Addition
51710	NGU	9068911	Norfolk Ns	2275060012	1862	10			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	603	11			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	2431	7			Addition
51710	NGU	9068911	Norfolk Ns	2275020000	2276	8			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	2212	425			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	2202	64			Addition
51710	NGU	9068911	Norfolk Ns	2275060012	2126	9			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	2102	8			Addition
51710	NGU	9068911	Norfolk Ns	2275001000	2001	5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	1210				Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275060012	2126				Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1315	2			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1200	106.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1202	81			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1311	39652			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1302	17.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	1239	1			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	2215	3.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	548	8.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	1819	91			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1742	1			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	1725				Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1633	10			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	2276	2			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1836	125.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	551				Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275060012	1519				Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	544	4			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	26	50.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275050012	2340				Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	2212	225.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275060012	2186	18			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275060011	999901	483.5			Revision
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275060011	1514				Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	2202	6.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1838	655.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	2013	25			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	2001	1128			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1995	36			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	1363	380.5			Addition

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275020000	1967	2.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	2170	5.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1957	131.5			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275050012	1892	34			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275060012	1869				Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1843	1			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1842	141			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1842	9			Addition
51810	NTU	12132011	OCEANA NAS /APOLLO SOUCEK FIELD/	2275001000	1988	15			Addition
53009	W28	12140611	SEQUIM VALLEY	2275060011	1516	1			This airport is a duplicate of FacilitySiteIdentifier W28

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
53009	W28	12140611	SEQUIM VALLEY	2275060011	2063	2			This airport is a duplicate of FacilitySiteIdentifier W28
53009	W28	12140611	SEQUIM VALLEY	2275060011	1598	1			This airport is a duplicate of FacilitySiteIdentifier W28
53055	S31	9083411	Lopez Island	2275060012	1519	2			This airport is a duplicate of FacilitySiteIdentifier S31
53055	S31	9083411	Lopez Island	2275060011	2063	6			This airport is a duplicate of FacilitySiteIdentifier S31
53055	S31	9083411	Lopez Island	2275060011	1601	312			This airport is a duplicate of FacilitySiteIdentifier S31
53055	S31	9083411	Lopez Island	2275060011	1598	493			This airport is a duplicate of FacilitySiteIdentifier S31
53055	FHR	9083811	Friday Harbor	2275060011	1516	13			This airport is a duplicate of FacilitySiteIdentifier FHR

Appendix C – State LTO Data

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
53055	S31	9083411	Lopez Island	2275060011	1516	7			This airport is a duplicate of FacilitySiteIdentifier S31
53055	FHR	9083811	Friday Harbor	2275060012	1519	1809			This airport is a duplicate of FacilitySiteIdentifier FHR
53055	FHR	9083811	Friday Harbor	2275060011	2063	475			This airport is a duplicate of FacilitySiteIdentifier FHR
53055	FHR	9083811	Friday Harbor	2275060011	1601	1032			This airport is a duplicate of FacilitySiteIdentifier FHR
53055	FHR	9083811	Friday Harbor	2275060011	1598	989			This airport is a duplicate of FacilitySiteIdentifier FHR
53055	FHR	9083811	Friday Harbor	2275060011	1517	5040			This airport is a duplicate of FacilitySiteIdentifier FHR
53055	FHR	9083811	Friday Harbor	2275060011	999901	0			Revision
53055	S31	9083411	Lopez Island	2275060012	999902	3124.8			Revision
53055	S31	9083411	Lopez Island	2275060011	999901	55.2			Revision
53055	ORS	9083611	Orcas Island	2275060012	999902	1535.22			Revision
53055	FHR	9083811	Friday Harbor	2275060012	999902	5229.43			Revision

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
53055	ORS	9083611	Orcas Island	2275060012	1519	1719			This airport is a duplicate of FacilitySiteIdentifier ORS
53055	38WA	9084011	Blakely Island Airport	2275060011	1598	1			This airport is a duplicate of FacilitySiteIdentifier 38WA
53055	ORS	9083611	Orcas Island	2275060011	1516	1			This airport is a duplicate of FacilitySiteIdentifier ORS
53055	ORS	9083611	Orcas Island	2275060011	1517	5040			This airport is a duplicate of FacilitySiteIdentifier ORS
53055	ORS	9083611	Orcas Island	2275060011	1598	3			This airport is a duplicate of FacilitySiteIdentifier ORS
53055	ORS	9083611	Orcas Island	2275060011	1601	1			This airport is a duplicate of FacilitySiteIdentifier ORS
53055	ORS	9083611	Orcas Island	2275060011	2063	282			This airport is a duplicate of FacilitySiteIdentifier ORS
53055	ORS	9083611	Orcas Island	2275060011	999901	0			Revision
53057	74S	9082811	Anacortes	2275060011	999901	0			Revision

Appendix C – State LTO Data

FIP Code	Facility SiteID	EIS Facility SiteID	Airport	SCC	AETC	Revised LTO	Revised Taxi_In	Revised Taxi_Out	Revision Comment
53057	74S	9082811	Anacortes	2275060011	1516	2			This airport is a duplicate of FacilitySiteIdentifier 74S
53057	74S	9082811	Anacortes	2275060011	1517	3360			This airport is a duplicate of FacilitySiteIdentifier 74S

Appendix D - Generic Aircraft Type Emission Factors

SCC	Process Description	CAS No	Pollutant	Emission factors (tons/LTO)
2275001000	Aircraft/Military	100414	Ethyl Benzene	1.25E-06
2275001000	Aircraft/Military	100425	Styrene	2.21E-06
2275001000	Aircraft/Military	106990	1,3-Butadiene	1.21E-05
2275001000	Aircraft/Military	107028	Acrolein	1.75E-05
2275001000	Aircraft/Military	108383	m-Xylene	2.02E-06
2275001000	Aircraft/Military	108883	Toluene	4.59E-06
2275001000	Aircraft/Military	108952	Phenol	5.20E-06
2275001000	Aircraft/Military	123386	Propionaldehyde	5.20E-06
2275001000	Aircraft/Military	50000	Formaldehyde	8.81E-05
2275001000	Aircraft/Military	67561	Methanol	1.29E-05
2275001000	Aircraft/Military	71432	Benzene	1.20E-05
2275001000	Aircraft/Military	75070	Acetaldehyde	3.06E-05
2275001000	Aircraft/Military	91203	Naphthalene	3.87E-06
2275001000	Aircraft/Military	91576	2-Methylnaphthalene	1.47E-06
2275001000	Aircraft/Military	95476	o-Xylene	1.19E-06
2275001000	Aircraft/Military	98828	Cumene	2.15E-08
2275001000	Aircraft/Military	CO	Carbon Monoxide	1.41E-02
2275001000	Aircraft/Military	NOX	Nitrogen Oxides	7.90E-05
2275001000	Aircraft/Military	PM10-PRI	PM10 Primary (Filt + Cond)	3.02E-04
2275001000	Aircraft/Military	PM25-PRI	PM2.5 Primary (Filt + Cond)	2.94E-04
2275001000	Aircraft/Military	SO2	Sulfur Dioxide	7.50E-06
2275001000	Aircraft/Military	VOC	Volatile Organic Compounds	7.10E-04
2275020000	Aircraft/Commercial	100414	Ethyl Benzene	5.41E-06
2275020000	Aircraft/Commercial	100425	Styrene	9.61E-06
2275020000	Aircraft/Commercial	106990	1,3-Butadiene	5.24E-05
2275020000	Aircraft/Commercial	107028	Acrolein	7.61E-05
2275020000	Aircraft/Commercial	108383	m-Xylene	8.77E-06
2275020000	Aircraft/Commercial	108883	Toluene	2.00E-05
2275020000	Aircraft/Commercial	108952	Phenol	2.26E-05
2275020000	Aircraft/Commercial	123386	Propionaldehyde	2.26E-05
2275020000	Aircraft/Commercial	191242	Benzo[g,h,i,]Perylene	1.73E-11
2275020000	Aircraft/Commercial	193395	Indeno[1,2,3-c,d]Pyrene	2.05E-09
2275020000	Aircraft/Commercial	205992	Benzo[b]Fluoranthene	1.89E-09
2275020000	Aircraft/Commercial	206440	Fluoranthene	2.49E-09
2275020000	Aircraft/Commercial	207089	Benzo[k]Fluoranthene	1.89E-09
2275020000	Aircraft/Commercial	218019	Chrysene	1.31E-09
2275020000	Aircraft/Commercial	50000	Formaldehyde	3.83E-04
2275020000	Aircraft/Commercial	50328	Benzo[a]Pyrene	9.62E-10
2275020000	Aircraft/Commercial	53703	Dibenzo[a,h]Anthracene	2.55E-09
2275020000	Aircraft/Commercial	540841	2,2,4-Trimethylpentane	1.47E-06

Appendix D - Generic Aircraft Type Emission Factors

SCC	Process Description	CAS No	Pollutant	Emission factors (tons/LTO)
2275020000	Aircraft/Commercial	56553	Benz[a]Anthracene	1.30E-09
2275020000	Aircraft/Commercial	67561	Methanol	5.61E-05
2275020000	Aircraft/Commercial	71432	Benzene	5.23E-05
2275020000	Aircraft/Commercial	75070	Acetaldehyde	1.33E-04
2275020000	Aircraft/Commercial	85018	Phenanthrene	1.11E-08
2275020000	Aircraft/Commercial	91203	Naphthalene	1.68E-05
2275020000	Aircraft/Commercial	91576	2-Methylnaphthalene	6.40E-06
2275020000	Aircraft/Commercial	95476	o-Xylene	5.16E-06
2275020000	Aircraft/Commercial	98828	Cumene	9.33E-08
2275020000	Aircraft/Commercial	CO	Carbon Monoxide	1.12E-02
2275020000	Aircraft/Commercial	NOX	Nitrogen Oxides	9.29E-03
2275020000	Aircraft/Commercial	PM10-PRI	PM10 Primary (Filt + Cond)	5.39E-04
2275020000	Aircraft/Commercial	PM25-PRI	PM2.5 Primary (Filt + Cond)	5.26E-04
2275020000	Aircraft/Commercial	SO2	Sulfur Dioxide	8.91E-04
2275020000	Aircraft/Commercial	VOC	Volatile Organic Compounds	3.08E-03
2275050011	Aircraft /General Aviation /Piston	100414	Ethyl Benzene	1.39E-06
2275050011	Aircraft /General Aviation /Piston	100425	Styrene	3.22E-07
2275050011	Aircraft /General Aviation /Piston	106990	1,3-Butadiene	9.28E-07
2275050011	Aircraft /General Aviation /Piston	107028	Acrolein	5.68E-08
2275050011	Aircraft /General Aviation /Piston	108883	Toluene	9.85E-06
2275050011	Aircraft /General Aviation /Piston	110543	Hexane	6.63E-07
2275050011	Aircraft /General Aviation /Piston	120127	Anthracene	1.01E-07
2275050011	Aircraft /General Aviation /Piston	123386	Propionaldehyde	5.68E-08
2275050011	Aircraft /General Aviation /Piston	1330207	Xylenes (Mixed Isomers)	5.55E-06
2275050011	Aircraft /General Aviation /Piston	191242	Benzo[g,h,i,]Perylene	3.08E-08
2275050011	Aircraft /General Aviation /Piston	193395	Indeno[1,2,3-c,d]Pyrene	9.47E-09
2275050011	Aircraft /General Aviation /Piston	205992	Benzo[b]Fluoranthene	1.42E-08
2275050011	Aircraft /General Aviation /Piston	206440	Fluoranthene	1.08E-07
2275050011	Aircraft /General Aviation /Piston	207089	Benzo[k]Fluoranthene	1.42E-08
2275050011	Aircraft /General Aviation /Piston	208968	Acenaphthylene	4.88E-07
2275050011	Aircraft /General Aviation /Piston	218019	Chrysene	1.18E-08
2275050011	Aircraft /General Aviation /Piston	50000	Formaldehyde	2.55E-06
2275050011	Aircraft /General Aviation /Piston	50328	Benzo[a]Pyrene	1.18E-08
2275050011	Aircraft /General Aviation /Piston	540841	2,2,4-Trimethylpentane	3.39E-08
2275050011	Aircraft /General Aviation /Piston	56553	Benz[a]Anthracene	1.18E-08
2275050011	Aircraft /General Aviation /Piston	71432	Benzene	3.84E-06
2275050011	Aircraft /General Aviation /Piston	7439921	Lead	7.69E-06
2275050011	Aircraft /General Aviation /Piston	75070	Acetaldehyde	5.87E-07
2275050011	Aircraft /General Aviation /Piston	83329	Acenaphthene	8.64E-08
2275050011	Aircraft /General Aviation /Piston	85018	Phenanthrene	3.01E-07

Appendix D - Generic Aircraft Type Emission Factors

SCC	Process Description	CAS No	Pollutant	Emission factors (tons/LTO)
2275050011	Aircraft /General Aviation /Piston	86737	Fluorene	1.79E-07
2275050011	Aircraft /General Aviation /Piston	91203	Naphthalene	1.07E-05
2275050011	Aircraft /General Aviation /Piston	91203	Naphthalene	4.33E-07
2275050011	Aircraft /General Aviation /Piston	CO	Carbon Monoxide	6.01E-03
2275050011	Aircraft /General Aviation /Piston	NOX	Nitrogen Oxides	3.25E-05
2275050011	Aircraft /General Aviation /Piston	PM10-PRI	PM10 Primary (Filt + Cond)	1.18E-04
2275050011	Aircraft /General Aviation /Piston	PM25-PRI	PM2.5 Primary (Filt + Cond)	8.17E-05
2275050011	Aircraft /General Aviation /Piston	SO2	Sulfur Dioxide	5.00E-06
2275050011	Aircraft /General Aviation /Piston	VOC	Volatile Organic Compounds	7.52E-05
2275050012	Aircraft /General Aviation /Turbine	100414	Ethyl Benzene	6.05E-07
2275050012	Aircraft /General Aviation /Turbine	100425	Styrene	1.07E-06
2275050012	Aircraft /General Aviation /Turbine	106990	1,3-Butadiene	5.87E-06
2275050012	Aircraft /General Aviation /Turbine	107028	Acrolein	8.52E-06
2275050012	Aircraft /General Aviation /Turbine	108383	m-Xylene	9.81E-07
2275050012	Aircraft /General Aviation /Turbine	108883	Toluene	2.23E-06
2275050012	Aircraft /General Aviation /Turbine	108952	Phenol	2.52E-06
2275050012	Aircraft /General Aviation /Turbine	120127	Anthracene	5.22E-11
2275050012	Aircraft /General Aviation /Turbine	123386	Propionaldehyde	2.53E-06
2275050012	Aircraft /General Aviation /Turbine	191242	Benzo[g,h,i,]Perylene	7.18E-13
2275050012	Aircraft /General Aviation /Turbine	206440	Fluoranthene	1.09E-10
2275050012	Aircraft /General Aviation /Turbine	218019	Chrysene	7.36E-12
2275050012	Aircraft /General Aviation /Turbine	50000	Formaldehyde	4.28E-05
2275050012	Aircraft /General Aviation /Turbine	50328	Benzo[a]Pyrene	4.33E-12
2275050012	Aircraft /General Aviation /Turbine	540841	2,2,4-Trimethylpentane	1.31E-07
2275050012	Aircraft /General Aviation /Turbine	56553	Benz[a]Anthracene	7.90E-12
2275050012	Aircraft /General Aviation /Turbine	67561	Methanol	6.28E-06
2275050012	Aircraft /General Aviation /Turbine	71432	Benzene	5.85E-06
2275050012	Aircraft /General Aviation /Turbine	75070	Acetaldehyde	1.49E-05
2275050012	Aircraft /General Aviation /Turbine	85018	Phenanthrene	4.86E-10
2275050012	Aircraft /General Aviation /Turbine	91203	Naphthalene	1.88E-06
2275050012	Aircraft /General Aviation /Turbine	91576	2-Methylnaphthalene	7.16E-07
2275050012	Aircraft /General Aviation /Turbine	95476	o-Xylene	5.77E-07
2275050012	Aircraft /General Aviation /Turbine	98828	Cumene	1.04E-08
2275050012	Aircraft /General Aviation /Turbine	CO	Carbon Monoxide	4.79E-03
2275050012	Aircraft /General Aviation /Turbine	NOX	Nitrogen Oxides	1.62E-04
2275050012	Aircraft /General Aviation /Turbine	PM10-PRI	PM10 Primary (Filt + Cond)	1.18E-04
2275050012	Aircraft /General Aviation /Turbine	PM25-PRI	PM2.5 Primary (Filt + Cond)	1.16E-04
2275050012	Aircraft /General Aviation /Turbine	SO2	Sulfur Dioxide	3.68E-05
2275050012	Aircraft /General Aviation /Turbine	VOC	Volatile Organic Compounds	3.45E-04
2275060011	Aircraft /Air Taxi /Piston	100414	Ethyl Benzene	1.39E-06

Appendix D - Generic Aircraft Type Emission Factors

SCC	Process Description	CAS No	Pollutant	Emission factors (tons/LTO)
2275060011	Aircraft /Air Taxi /Piston	100425	Styrene	3.22E-07
2275060011	Aircraft /Air Taxi /Piston	106990	1,3-Butadiene	9.28E-07
2275060011	Aircraft /Air Taxi /Piston	107028	Acrolein	5.68E-08
2275060011	Aircraft /Air Taxi /Piston	108883	Toluene	9.85E-06
2275060011	Aircraft /Air Taxi /Piston	110543	Hexane	6.63E-07
2275060011	Aircraft /Air Taxi /Piston	120127	Anthracene	2.56E-07
2275060011	Aircraft /Air Taxi /Piston	123386	Propionaldehyde	5.68E-08
2275060011	Aircraft /Air Taxi /Piston	1330207	Xylenes (Mixed Isomers)	5.55E-06
2275060011	Aircraft /Air Taxi /Piston	191242	Benzo[g,h,i,]Perylene	7.84E-08
2275060011	Aircraft /Air Taxi /Piston	193395	Indeno[1,2,3-c,d]Pyrene	2.41E-08
2275060011	Aircraft /Air Taxi /Piston	205992	Benzo[b]Fluoranthene	3.62E-08
2275060011	Aircraft /Air Taxi /Piston	206440	Fluoranthene	2.75E-07
2275060011	Aircraft /Air Taxi /Piston	207089	Benzo[k]Fluoranthene	3.62E-08
2275060011	Aircraft /Air Taxi /Piston	208968	Acenaphthylene	1.24E-06
2275060011	Aircraft /Air Taxi /Piston	218019	Chrysene	3.02E-08
2275060011	Aircraft /Air Taxi /Piston	50000	Formaldehyde	2.55E-06
2275060011	Aircraft /Air Taxi /Piston	50328	Benzo[a]Pyrene	3.02E-08
2275060011	Aircraft /Air Taxi /Piston	540841	2,2,4-Trimethylpentane	3.39E-08
2275060011	Aircraft /Air Taxi /Piston	56553	Benz[a]Anthracene	3.02E-08
2275060011	Aircraft /Air Taxi /Piston	71432	Benzene	3.84E-06
2275060011	Aircraft /Air Taxi /Piston	7439921	Lead	7.69E-06
2275060011	Aircraft /Air Taxi /Piston	75070	Acetaldehyde	5.87E-07
2275060011	Aircraft /Air Taxi /Piston	83329	Acenaphthene	2.20E-07
2275060011	Aircraft /Air Taxi /Piston	85018	Phenanthrene	7.66E-07
2275060011	Aircraft /Air Taxi /Piston	86737	Fluorene	4.56E-07
2275060011	Aircraft /Air Taxi /Piston	91203	Naphthalene	2.74E-05
2275060011	Aircraft /Air Taxi /Piston	91203	Naphthalene	4.33E-07
2275060011	Aircraft /Air Taxi /Piston	CO	Carbon Monoxide	1.41E-02
2275060011	Aircraft /Air Taxi /Piston	NOX	Nitrogen Oxides	7.90E-05
2275060011	Aircraft /Air Taxi /Piston	PM10-PRI	PM10 Primary (Filt + Cond)	3.02E-04
2275060011	Aircraft /Air Taxi /Piston	PM25-PRI	PM2.5 Primary (Filt + Cond)	2.08E-04
2275060011	Aircraft /Air Taxi /Piston	SO2	Sulfur Dioxide	7.50E-06
2275060011	Aircraft /Air Taxi /Piston	VOC	Volatile Organic Compounds	8.48E-05
2275060012	Aircraft /Air Taxi /Turbine	100414	Ethyl Benzene	8.83E-07
2275060012	Aircraft /Air Taxi /Turbine	100425	Styrene	1.57E-06
2275060012	Aircraft /Air Taxi /Turbine	106990	1,3-Butadiene	8.56E-06
2275060012	Aircraft /Air Taxi /Turbine	107028	Acrolein	1.24E-05
2275060012	Aircraft /Air Taxi /Turbine	108383	m-Xylene	1.43E-06
2275060012	Aircraft /Air Taxi /Turbine	108883	Toluene	3.26E-06
2275060012	Aircraft /Air Taxi /Turbine	108952	Phenol	3.68E-06

Appendix D - Generic Aircraft Type Emission Factors

SCC	Process Description	CAS No	Pollutant	Emission factors (tons/LTO)
2275060012	Aircraft /Air Taxi /Turbine	120127	Anthracene	1.33E-10
2275060012	Aircraft /Air Taxi /Turbine	123386	Propionaldehyde	3.69E-06
2275060012	Aircraft /Air Taxi /Turbine	191242	Benzo[g,h,i,]Perylene	1.83E-12
2275060012	Aircraft /Air Taxi /Turbine	206440	Fluoranthene	2.78E-10
2275060012	Aircraft /Air Taxi /Turbine	218019	Chrysene	1.88E-11
2275060012	Aircraft /Air Taxi /Turbine	50000	Formaldehyde	6.25E-05
2275060012	Aircraft /Air Taxi /Turbine	50328	Benzo[a]Pyrene	1.10E-11
2275060012	Aircraft /Air Taxi /Turbine	540841	2,2,4-Trimethylpentane	1.92E-07
2275060012	Aircraft /Air Taxi /Turbine	56553	Benz[a]Anthracene	2.01E-11
2275060012	Aircraft /Air Taxi /Turbine	67561	Methanol	9.16E-06
2275060012	Aircraft /Air Taxi /Turbine	71432	Benzene	8.53E-06
2275060012	Aircraft /Air Taxi /Turbine	75070	Acetaldehyde	2.17E-05
2275060012	Aircraft /Air Taxi /Turbine	85018	Phenanthrene	1.24E-09
2275060012	Aircraft /Air Taxi /Turbine	91203	Naphthalene	2.74E-06
2275060012	Aircraft /Air Taxi /Turbine	91576	2-Methylnaphthalene	1.05E-06
2275060012	Aircraft /Air Taxi /Turbine	95476	o-Xylene	8.42E-07
2275060012	Aircraft /Air Taxi /Turbine	98828	Cumene	1.52E-08
2275060012	Aircraft /Air Taxi /Turbine	CO	Carbon Monoxide	1.81E-03
2275060012	Aircraft /Air Taxi /Turbine	NOX	Nitrogen Oxides	3.88E-04
2275060012	Aircraft /Air Taxi /Turbine	PM10-PRI	PM10 Primary (Filt + Cond)	3.02E-04
2275060012	Aircraft /Air Taxi /Turbine	PM25-PRI	PM2.5 Primary (Filt + Cond)	2.94E-04
2275060012	Aircraft /Air Taxi /Turbine	SO2	Sulfur Dioxide	8.12E-05
2275060012	Aircraft /Air Taxi /Turbine	VOC	Volatile Organic Compounds	5.03E-04

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	2,2,4-Trimethylpentane	540841	5.58
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Acetaldehyde	75070	1.80
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Benzene	71432	6.51
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Carbon Monoxide	CO	11,598.44
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Ethyl Benzene	100414	2.49
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Formaldehyde	50000	5.33
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Methane	CH4	9.12
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	m-Xylene	108383	6.92
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Nitrogen Oxides	NOX	1,244.00
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	o-Xylene	95476	3.39
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	PM10 Primary (Filt + Cond)	PM10-PRI	39.97
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	PM2.5 Primary (Filt + Cond)	PM25-PRI	38.25
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Propionaldehyde	123386	1.10
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Sulfur Dioxide	SO2	25.74
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Toluene	108883	11.09
2265008005	GSE-Off-highway Vehicle Gasoline, 4-Stroke	Volatile Organic Compounds	VOC	393.87
2267008005	GSE-LPG	2,2,4-Trimethylpentane	540841	0.55
2267008005	GSE-LPG	Acetaldehyde	75070	0.18
2267008005	GSE-LPG	Benzene	71432	0.64
2267008005	GSE-LPG	Carbon Monoxide	CO	1,139.35
2267008005	GSE-LPG	Ethyl Benzene	100414	0.24
2267008005	GSE-LPG	Formaldehyde	50000	0.52
2267008005	GSE-LPG	Methane	CH4	0.90
2267008005	GSE-LPG	m-Xylene	108383	0.68
2267008005	GSE-LPG	Nitrogen Oxides	NOX	122.20
2267008005	GSE-LPG	o-Xylene	95476	0.33

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2267008005	GSE-LPG	PM10 Primary (Filt + Cond)	PM10-PRI	3.93
2267008005	GSE-LPG	PM2.5 Primary (Filt + Cond)	PM25-PRI	3.76
2267008005	GSE-LPG	Propionaldehyde	123386	0.11
2267008005	GSE-LPG	Sulfur Dioxide	SO2	2.53
2267008005	GSE-LPG	Toluene	108883	1.09
2267008005	GSE-LPG	Volatile Organic Compounds	VOC	38.69
2268008005	GSE-CNG	2,2,4-Trimethylpentane	540841	0.43
2268008005	GSE-CNG	Acetaldehyde	75070	0.14
2268008005	GSE-CNG	Benzene	71432	0.51
2268008005	GSE-CNG	Carbon Monoxide	CO	900.99
2268008005	GSE-CNG	Ethyl Benzene	100414	0.19
2268008005	GSE-CNG	Formaldehyde	50000	0.41
2268008005	GSE-CNG	Methane	CH4	0.71
2268008005	GSE-CNG	m-Xylene	108383	0.54
2268008005	GSE-CNG	Nitrogen Oxides	NOX	96.64
2268008005	GSE-CNG	o-Xylene	95476	0.26
2268008005	GSE-CNG	PM10 Primary (Filt + Cond)	PM10-PRI	3.10
2268008005	GSE-CNG	PM2.5 Primary (Filt + Cond)	PM25-PRI	2.97
2268008005	GSE-CNG	Propionaldehyde	123386	0.085
2268008005	GSE-CNG	Sulfur Dioxide	SO2	2.00
2268008005	GSE-CNG	Toluene	108883	0.86
2268008005	GSE-CNG	Volatile Organic Compounds	VOC	30.60
2270008005	GSE-Off-highway Vehicle Diesel	2,2,4-Trimethylpentane	540841	26.55
2270008005	GSE-Off-highway Vehicle Diesel	Acetaldehyde	75070	8.56
2270008005	GSE-Off-highway Vehicle Diesel	Benzene	71432	30.97
2270008005	GSE-Off-highway Vehicle Diesel	Carbon Monoxide	CO	55,146.21

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2270008005	GSE-Off-highway Vehicle Diesel	Ethyl Benzene	100414	11.86
2270008005	GSE-Off-highway Vehicle Diesel	Formaldehyde	50000	25.34
2270008005	GSE-Off-highway Vehicle Diesel	Methane	CH4	43.36
2270008005	GSE-Off-highway Vehicle Diesel	m-Xylene	108383	32.92
2270008005	GSE-Off-highway Vehicle Diesel	Nitrogen Oxides	NOX	5,914.76
2270008005	GSE-Off-highway Vehicle Diesel	o-Xylene	95476	16.10
2270008005	GSE-Off-highway Vehicle Diesel	PM10 Primary (Filt + Cond)	PM10-PRI	190.04
2270008005	GSE-Off-highway Vehicle Diesel	PM2.5 Primary (Filt + Cond)	PM25-PRI	181.85
2270008005	GSE-Off-highway Vehicle Diesel	Propionaldehyde	123386	5.21
2270008005	GSE-Off-highway Vehicle Diesel	Sulfur Dioxide	SO2	122.37
2270008005	GSE-Off-highway Vehicle Diesel	Toluene	108883	52.74
2270008005	GSE-Off-highway Vehicle Diesel	Volatile Organic Compounds	VOC	1,872.69
2275001000	Aircraft/Military	1,3-Butadiene	106990	63.73
2275001000	Aircraft/Military	1-Methylnaphthalene	90120	9.33
2275001000	Aircraft/Military	2-Methylnaphthalene	91576	7.78
2275001000	Aircraft/Military	Acetaldehyde	75070	161.38
2275001000	Aircraft/Military	Acrolein	107028	92.52
2275001000	Aircraft/Military	Benzene	71432	63.50
2275001000	Aircraft/Military	Carbon Dioxide	CO2	348,115.75
2275001000	Aircraft/Military	Carbon Monoxide	CO	38,989.65
2275001000	Aircraft/Military	Cumene	98828	0.11
2275001000	Aircraft/Military	Ethyl Benzene	100414	6.57
2275001000	Aircraft/Military	Formaldehyde	50000	465.04
2275001000	Aircraft/Military	Methane	CH4	0.0082
2275001000	Aircraft/Military	Methanol	67561	68.19
2275001000	Aircraft/Military	m-Xylene	108383	10.65

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275001000	Aircraft/Military	Naphthalene	91203	10.87
2275001000	Aircraft/Military	Nitrogen Oxides	NOX	1,071.98
2275001000	Aircraft/Military	o-Xylene	95476	6.27
2275001000	Aircraft/Military	Phenol	108952	27.43
2275001000	Aircraft/Military	PM10 Primary (Filt + Cond)	PM10-PRI	745.72
2275001000	Aircraft/Military	PM2.5 Primary (Filt + Cond)	PM25-PRI	727.82
2275001000	Aircraft/Military	Propionaldehyde	123386	27.46
2275001000	Aircraft/Military	Styrene	100425	11.67
2275001000	Aircraft/Military	Sulfur Dioxide	SO2	161.11
2275001000	Aircraft/Military	Toluene	108883	24.25
2275001000	Aircraft/Military	Volatile Organic Compounds	VOC	3,752.06
2275020000	Aircraft/Commercial	1,3-Butadiene	106990	210.93
2275020000	Aircraft/Commercial	1-Methylnaphthalene	90120	30.88
2275020000	Aircraft/Commercial	2,2,4-Trimethylpentane	540841	0.40
2275020000	Aircraft/Commercial	2-Methylnaphthalene	91576	25.76
2275020000	Aircraft/Commercial	Acetaldehyde	75070	534.14
2275020000	Aircraft/Commercial	Acrolein	107028	306.21
2275020000	Aircraft/Commercial	Benz[a]Anthracene	56553	0.00035
2275020000	Aircraft/Commercial	Benzene	71432	210.18
2275020000	Aircraft/Commercial	Benzo[a]Pyrene	50328	0.00026
2275020000	Aircraft/Commercial	Benzo[b]Fluoranthene	205992	0.00051
2275020000	Aircraft/Commercial	Benzo[g,h,i,]Perylene	191242	0.0000047
2275020000	Aircraft/Commercial	Benzo[k]Fluoranthene	207089	0.00051
2275020000	Aircraft/Commercial	Carbon Dioxide	CO2	28,289,313.88
2275020000	Aircraft/Commercial	Carbon Monoxide	CO	98,343.42
2275020000	Aircraft/Commercial	Chrysene	218019	0.00036

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275020000	Aircraft/Commercial	Cumene	98828	0.38
2275020000	Aircraft/Commercial	Dibenzo[a,h]Anthracene	53703	0.00069
2275020000	Aircraft/Commercial	Ethyl Benzene	100414	21.76
2275020000	Aircraft/Commercial	Fluoranthene	206440	0.00068
2275020000	Aircraft/Commercial	Formaldehyde	50000	1,539.17
2275020000	Aircraft/Commercial	Indeno[1,2,3-c,d]Pyrene	193395	0.00056
2275020000	Aircraft/Commercial	Methanol	67561	225.69
2275020000	Aircraft/Commercial	m-Xylene	108383	35.26
2275020000	Aircraft/Commercial	Naphthalene	91203	63.08
2275020000	Aircraft/Commercial	Nitrogen Oxides	NOX	104,045.49
2275020000	Aircraft/Commercial	o-Xylene	95476	20.76
2275020000	Aircraft/Commercial	Phenanthrene	85018	0.00302
2275020000	Aircraft/Commercial	Phenol	108952	90.77
2275020000	Aircraft/Commercial	PM10 Primary (Filt + Cond)	PM10-PRI	1,447.84
2275020000	Aircraft/Commercial	PM2.5 Primary (Filt + Cond)	PM25-PRI	1,444.34
2275020000	Aircraft/Commercial	Propionaldehyde	123386	90.90
2275020000	Aircraft/Commercial	Pyrene	129000	0.00082
2275020000	Aircraft/Commercial	Styrene	100425	38.64
2275020000	Aircraft/Commercial	Sulfur Dioxide	SO2	12,456.33
2275020000	Aircraft/Commercial	Toluene	108883	80.27
2275020000	Aircraft/Commercial	Volatile Organic Compounds	VOC	15,093.60
2275050011	Aircraft /General Aviation /Piston	1,3-Butadiene	106990	28.73
2275050011	Aircraft /General Aviation /Piston	1-Methylnaphthalene	90120	0.0000065
2275050011	Aircraft /General Aviation /Piston	2,2,4-Trimethylpentane	540841	1.02
2275050011	Aircraft /General Aviation /Piston	2-Methylnaphthalene	91576	0.0000055
2275050011	Aircraft /General Aviation /Piston	Acenaphthene	83329	2.60

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275050011	Aircraft /General Aviation /Piston	Acenaphthylene	208968	14.65
2275050011	Aircraft /General Aviation /Piston	Acetaldehyde	75070	19.95
2275050011	Aircraft /General Aviation /Piston	Acrolein	107028	2.81
2275050011	Aircraft /General Aviation /Piston	Anthracene	120127	3.02
2275050011	Aircraft /General Aviation /Piston	Benz[a]Anthracene	56553	0.36
2275050011	Aircraft /General Aviation /Piston	Benzene	71432	116.21
2275050011	Aircraft /General Aviation /Piston	Benzo[a]Pyrene	50328	0.36
2275050011	Aircraft /General Aviation /Piston	Benzo[b]Fluoranthene	205992	0.43
2275050011	Aircraft /General Aviation /Piston	Benzo[g,h,i,]Perylene	191242	0.92
2275050011	Aircraft /General Aviation /Piston	Benzo[k]Fluoranthene	207089	0.43
2275050011	Aircraft /General Aviation /Piston	Carbon Dioxide	CO2	8,469.50
2275050011	Aircraft /General Aviation /Piston	Carbon Monoxide	CO	182,226.34
2275050011	Aircraft /General Aviation /Piston	Chrysene	218019	0.36
2275050011	Aircraft /General Aviation /Piston	Cumene	98828	0.000000080
2275050011	Aircraft /General Aviation /Piston	Ethyl Benzene	100414	41.91
2275050011	Aircraft /General Aviation /Piston	Fluoranthene	206440	3.23
2275050011	Aircraft /General Aviation /Piston	Fluorene	86737	5.37
2275050011	Aircraft /General Aviation /Piston	Formaldehyde	50000	84.11
2275050011	Aircraft /General Aviation /Piston	Hexane	110543	19.92
2275050011	Aircraft /General Aviation /Piston	Indeno[1,2,3-c,d]Pyrene	193395	0.28
2275050011	Aircraft /General Aviation /Piston	Lead	7439921	231.19
2275050011	Aircraft /General Aviation /Piston	Methane	CH4	5.86
2275050011	Aircraft /General Aviation /Piston	Methanol	67561	0.000048
2275050011	Aircraft /General Aviation /Piston	m-Xylene	108383	0.14
2275050011	Aircraft /General Aviation /Piston	Naphthalene	91203	335.70
2275050011	Aircraft /General Aviation /Piston	Nitrogen Oxides	NOX	981.73

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275050011	Aircraft /General Aviation /Piston	o-Xylene	95476	0.10
2275050011	Aircraft /General Aviation /Piston	Phenanthrene	85018	9.03
2275050011	Aircraft /General Aviation /Piston	Phenol	108952	0.12
2275050011	Aircraft /General Aviation /Piston	PM10 Primary (Filt + Cond)	PM10-PRI	3,554.86
2275050011	Aircraft /General Aviation /Piston	PM2.5 Primary (Filt + Cond)	PM25-PRI	2,452.86
2275050011	Aircraft /General Aviation /Piston	Propionaldehyde	123386	2.19
2275050011	Aircraft /General Aviation /Piston	Pyrene	129000	4.41
2275050011	Aircraft /General Aviation /Piston	Styrene	100425	9.87
2275050011	Aircraft /General Aviation /Piston	Sulfur Dioxide	SO2	153.65
2275050011	Aircraft /General Aviation /Piston	Toluene	108883	296.21
2275050011	Aircraft /General Aviation /Piston	Volatile Organic Compounds	VOC	2,305.45
2275050011	Aircraft /General Aviation /Piston	Xylenes (Mixed Isomers)	1330207	166.76
2275050012	Aircraft /General Aviation /Turbine	1,3-Butadiene	106990	65.10
2275050012	Aircraft /General Aviation /Turbine	1-Methylnaphthalene	90120	9.53
2275050012	Aircraft /General Aviation /Turbine	2,2,4-Trimethylpentane	540841	1.42
2275050012	Aircraft /General Aviation /Turbine	2-Methylnaphthalene	91576	7.95
2275050012	Aircraft /General Aviation /Turbine	Acetaldehyde	75070	164.84
2275050012	Aircraft /General Aviation /Turbine	Acrolein	107028	94.50
2275050012	Aircraft /General Aviation /Turbine	Anthracene	120127	0.00057
2275050012	Aircraft /General Aviation /Turbine	Benz[a]Anthracene	56553	0.000086
2275050012	Aircraft /General Aviation /Turbine	Benzene	71432	64.86
2275050012	Aircraft /General Aviation /Turbine	Benzo[a]Pyrene	50328	0.000047
2275050012	Aircraft /General Aviation /Turbine	Benzo[g,h,i,]Perylene	191242	0.0000078
2275050012	Aircraft /General Aviation /Turbine	Carbon Dioxide	CO2	39,044.06
2275050012	Aircraft /General Aviation /Turbine	Carbon Monoxide	CO	52,250.61
2275050012	Aircraft /General Aviation /Turbine	Chrysene	218019	0.000080

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275050012	Aircraft /General Aviation /Turbine	Cumene	98828	0.12
2275050012	Aircraft /General Aviation /Turbine	Ethyl Benzene	100414	6.71
2275050012	Aircraft /General Aviation /Turbine	Fluoranthene	206440	0.0012
2275050012	Aircraft /General Aviation /Turbine	Formaldehyde	50000	475.01
2275050012	Aircraft /General Aviation /Turbine	Methanol	67561	69.65
2275050012	Aircraft /General Aviation /Turbine	m-Xylene	108383	10.88
2275050012	Aircraft /General Aviation /Turbine	Naphthalene	91203	0.46
2275050012	Aircraft /General Aviation /Turbine	Nitrogen Oxides	NOX	1,836.64
2275050012	Aircraft /General Aviation /Turbine	o-Xylene	95476	6.41
2275050012	Aircraft /General Aviation /Turbine	Phenanthrene	85018	0.0053
2275050012	Aircraft /General Aviation /Turbine	Phenol	108952	28.01
2275050012	Aircraft /General Aviation /Turbine	PM10 Primary (Filt + Cond)	PM10-PRI	1,286.96
2275050012	Aircraft /General Aviation /Turbine	PM2.5 Primary (Filt + Cond)	PM25-PRI	1,256.14
2275050012	Aircraft /General Aviation /Turbine	Propionaldehyde	123386	28.05
2275050012	Aircraft /General Aviation /Turbine	Pyrene	129000	0.0014
2275050012	Aircraft /General Aviation /Turbine	Styrene	100425	11.92
2275050012	Aircraft /General Aviation /Turbine	Sulfur Dioxide	SO2	415.19
2275050012	Aircraft /General Aviation /Turbine	Toluene	108883	24.77
2275050012	Aircraft /General Aviation /Turbine	Volatile Organic Compounds	VOC	3,832.92
2275060011	Aircraft /Air Taxi /Piston	1,3-Butadiene	106990	9.71
2275060011	Aircraft /Air Taxi /Piston	1-Methylnaphthalene	90120	0.51
2275060011	Aircraft /Air Taxi /Piston	2,2,4-Trimethylpentane	540841	0.039
2275060011	Aircraft /Air Taxi /Piston	2-Methylnaphthalene	91576	0.42
2275060011	Aircraft /Air Taxi /Piston	Acenaphthene	83329	0.25
2275060011	Aircraft /Air Taxi /Piston	Acenaphthylene	208968	1.42
2275060011	Aircraft /Air Taxi /Piston	Acetaldehyde	75070	23.73

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275060011	Aircraft /Air Taxi /Piston	Acrolein	107028	11.90
2275060011	Aircraft /Air Taxi /Piston	Anthracene	120127	0.29
2275060011	Aircraft /Air Taxi /Piston	Benz[a]Anthracene	56553	0.034
2275060011	Aircraft /Air Taxi /Piston	Benzene	71432	13.74
2275060011	Aircraft /Air Taxi /Piston	Benzo[a]Pyrene	50328	0.034
2275060011	Aircraft /Air Taxi /Piston	Benzo[b]Fluoranthene	205992	0.041
2275060011	Aircraft /Air Taxi /Piston	Benzo[g,h,i,]Perylene	191242	0.089
2275060011	Aircraft /Air Taxi /Piston	Benzo[k]Fluoranthene	207089	0.041
2275060011	Aircraft /Air Taxi /Piston	Carbon Dioxide	CO2	400,352.06
2275060011	Aircraft /Air Taxi /Piston	Carbon Monoxide	CO	31,536.24
2275060011	Aircraft /Air Taxi /Piston	Chrysene	218019	0.034
2275060011	Aircraft /Air Taxi /Piston	Cumene	98828	0.006
2275060011	Aircraft /Air Taxi /Piston	Ethyl Benzene	100414	2.44
2275060011	Aircraft /Air Taxi /Piston	Fluoranthene	206440	0.31
2275060011	Aircraft /Air Taxi /Piston	Fluorene	86737	0.52
2275060011	Aircraft /Air Taxi /Piston	Formaldehyde	50000	74.95
2275060011	Aircraft /Air Taxi /Piston	Hexane	110543	0.76
2275060011	Aircraft /Air Taxi /Piston	Indeno[1,2,3-c,d]Pyrene	193395	0.027
2275060011	Aircraft /Air Taxi /Piston	Lead	7439921	13.58
2275060011	Aircraft /Air Taxi /Piston	Methane	CH4	36.27
2275060011	Aircraft /Air Taxi /Piston	Methanol	67561	3.70
2275060011	Aircraft /Air Taxi /Piston	m-Xylene	108383	1.44
2275060011	Aircraft /Air Taxi /Piston	Naphthalene	91203	34.46
2275060011	Aircraft /Air Taxi /Piston	Nitrogen Oxides	NOX	2,529.63
2275060011	Aircraft /Air Taxi /Piston	o-Xylene	95476	0.94
2275060011	Aircraft /Air Taxi /Piston	Phenanthrene	85018	0.87

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275060011	Aircraft /Air Taxi /Piston	Phenol	108952	2.22
2275060011	Aircraft /Air Taxi /Piston	PM10 Primary (Filt + Cond)	PM10-PRI	409.24
2275060011	Aircraft /Air Taxi /Piston	PM2.5 Primary (Filt + Cond)	PM25-PRI	302.71
2275060011	Aircraft /Air Taxi /Piston	Propionaldehyde	123386	4.53
2275060011	Aircraft /Air Taxi /Piston	Pyrene	129000	0.43
2275060011	Aircraft /Air Taxi /Piston	Styrene	100425	2.23
2275060011	Aircraft /Air Taxi /Piston	Sulfur Dioxide	SO2	186.11
2275060011	Aircraft /Air Taxi /Piston	Toluene	108883	14.16
2275060011	Aircraft /Air Taxi /Piston	Volatile Organic Compounds	VOC	588.05
2275060011	Aircraft /Air Taxi /Piston	Xylenes (Mixed Isomers)	1330207	6.32
2275060012	Aircraft /Air Taxi /Turbine	1,3-Butadiene	106990	60.96
2275060012	Aircraft /Air Taxi /Turbine	1-Methylnaphthalene	90120	8.33
2275060012	Aircraft /Air Taxi /Turbine	2,2,4-Trimethylpentane	540841	0.69
2275060012	Aircraft /Air Taxi /Turbine	2-Methylnaphthalene	91576	6.95
2275060012	Aircraft /Air Taxi /Turbine	Acetaldehyde	75070	155.27
2275060012	Aircraft /Air Taxi /Turbine	Acrolein	107028	87.93
2275060012	Aircraft /Air Taxi /Turbine	Anthracene	120127	0.00048
2275060012	Aircraft /Air Taxi /Turbine	Benz[a]Anthracene	56553	0.000073
2275060012	Aircraft /Air Taxi /Turbine	Benzene	71432	61.33
2275060012	Aircraft /Air Taxi /Turbine	Benzo[a]Pyrene	50328	0.000040
2275060012	Aircraft /Air Taxi /Turbine	Benzo[g,h,i,]Perylene	191242	0.0000066
2275060012	Aircraft /Air Taxi /Turbine	Carbon Dioxide	CO2	858,795.59
2275060012	Aircraft /Air Taxi /Turbine	Carbon Monoxide	CO	15,304.05
2275060012	Aircraft /Air Taxi /Turbine	Chrysene	218019	0.000068
2275060012	Aircraft /Air Taxi /Turbine	Cumene	98828	0.10
2275060012	Aircraft /Air Taxi /Turbine	Ethyl Benzene	100414	6.26

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275060012	Aircraft /Air Taxi /Turbine	Fluoranthene	206440	0.00101
2275060012	Aircraft /Air Taxi /Turbine	Formaldehyde	50000	451.79
2275060012	Aircraft /Air Taxi /Turbine	Lead	7439921	0.0054
2275060012	Aircraft /Air Taxi /Turbine	Methane	CH4	28.35
2275060012	Aircraft /Air Taxi /Turbine	Methanol	67561	60.88
2275060012	Aircraft /Air Taxi /Turbine	m-Xylene	108383	10.18
2275060012	Aircraft /Air Taxi /Turbine	Naphthalene	91203	9.63
2275060012	Aircraft /Air Taxi /Turbine	Nitrogen Oxides	NOX	3,054.45
2275060012	Aircraft /Air Taxi /Turbine	o-Xylene	95476	6.06
2275060012	Aircraft /Air Taxi /Turbine	Phenanthrene	85018	0.00448
2275060012	Aircraft /Air Taxi /Turbine	Phenol	108952	25.06
2275060012	Aircraft /Air Taxi /Turbine	PM10 Primary (Filt + Cond)	PM10-PRI	1,104.69
2275060012	Aircraft /Air Taxi /Turbine	PM2.5 Primary (Filt + Cond)	PM25-PRI	1,078.49
2275060012	Aircraft /Air Taxi /Turbine	Propionaldehyde	123386	26.85
2275060012	Aircraft /Air Taxi /Turbine	Pyrene	129000	0.0012
2275060012	Aircraft /Air Taxi /Turbine	Styrene	100425	11.38
2275060012	Aircraft /Air Taxi /Turbine	Sulfur Dioxide	SO2	723.24
2275060012	Aircraft /Air Taxi /Turbine	Toluene	108883	22.92
2275060012	Aircraft /Air Taxi /Turbine	Volatile Organic Compounds	VOC	3,605.02
2275070000	APU	1,3-Butadiene	106990	4.67
2275070000	APU	1-Methylnaphthalene	90120	0.68
2275070000	APU	2-Methylnaphthalene	91576	0.57
2275070000	APU	Acetaldehyde	75070	11.82
2275070000	APU	Acrolein	107028	6.77
2275070000	APU	Benzene	71432	4.65
2275070000	APU	Carbon Monoxide	CO	3,576.93

Appendix E – Total Annual Emissions by SCC

SCC	SCC Description	Pollutant	Pollutant CAS	Emissions (Ton)
2275070000	APU	Cumene	98828	0.0083
2275070000	APU	Ethyl Benzene	100414	0.48
2275070000	APU	Formaldehyde	50000	34.05
2275070000	APU	Methanol	67561	4.99
2275070000	APU	m-Xylene	108383	0.78
2275070000	APU	Naphthalene	91203	1.50
2275070000	APU	Nitrogen Oxides	NOX	2,716.64
2275070000	APU	o-Xylene	95476	0.46
2275070000	APU	Phenol	108952	2.01
2275070000	APU	PM10 Primary (Filt + Cond)	PM10-PRI	410.24
2275070000	APU	PM2.5 Primary (Filt + Cond)	PM25-PRI	410.24
2275070000	APU	Propionaldehyde	123386	2.01
2275070000	APU	Styrene	100425	0.85
2275070000	APU	Sulfur Dioxide	SO2	412.29
2275070000	APU	Toluene	108883	1.78
2275070000	APU	Volatile Organic Compounds	VOC	275.18

Appendix B-6

Development of 2011 Railroad Component for National Emissions Inventory

MEMORANDUM

TO: Laurel Driver/US EPA

FROM: Heather Perez, Susan McClutchey, and Richard Billings/ERG

DATE: September 5, 2012

SUBJECT: Development of 2011 Railroad Component for National Emissions Inventory

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1.0 Introduction

As part of Work Assignment 5-07 under EPA Contract EP-D-07-097, entitled "Mobile Source Emission Inventories – FY12," ERG developed growth factors for Class I and Class II and III railroads that were applied to the 2008 emission values developed for the National Emission Inventory (NEI) to approximate emission levels in 2011. The emissions were allocated to line haul shape IDs and yard locations based on 2008 allocations. ERG provided the EPA with the 2011 estimated railroad emissions as an Access database for inclusion into EIS staging tables by the EPA WAM.

This report documents the development of the growth factors (Section 2), application of these growth factors to 2008 data are discussed in Section 3 along with a summary of the 2001 emissions estimates. Lastly A listing of references used in this study are presented in Section 4.

2.0 2008/2011 Railroad Growth Factors

Railroad freight traffic data were obtained from a variety of sources including the Department of Transportation's Bureau of Transportation Statistics (BTS) and Surface Transportation Board, The Department of Energy's Annual Energy Outlook (AEO), the American Association of Railroads (AAR), and the American Short Lines and Regional Railroad Association.

Initially growth rates were reviewed as reported for the AEO's 2012 reference case. These rates were developed relative to billions of ton miles traveled. Data that specifically covered the period from 2008 to 2011 were not included in the data table, so earlier reports (2008-2011) were compiled and reviewed. When the separate reports were evaluated together, the actual and projected annual growth rates were inconsistent. This observation suggested that the commercial rail freight market had a high degree of uncertainty associated with it for the study period.

This observation about the volatility of the market was substantiated when aggregated quarterly rail traffic data from the BTS were reviewed. Their data showed a peak in 2008 followed by a significant decline in activity for multimodal rail traffic. Gradually the rail freight market was returning to the 2008 activity level, though the 2011 data point suggests that activities were slightly under the 2008 peak. Note that the rail traffic data presented in Figure 1 is for intermodal freight traffic and is only provided as a general indicator of rail activities.

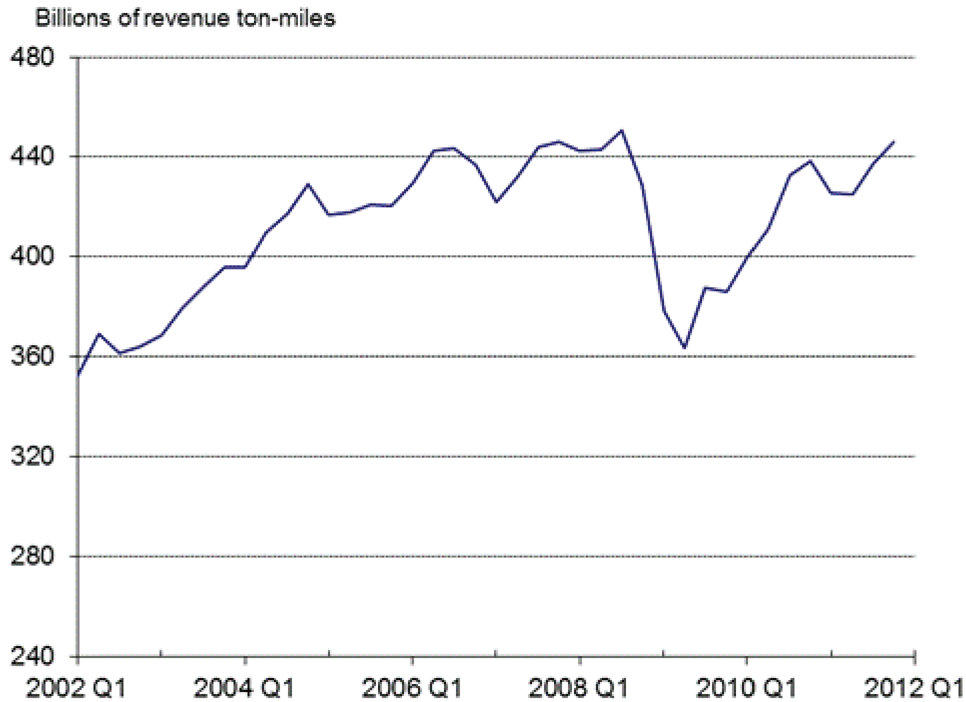

Figure 1. Intermodal Rail Traffic 2002 to 2012

ERG compiled railroad freight traffic data from the 2008 and 2011 R-1 reports submitted by all Class I rail lines to the Surface Transportation Board. The R-1 data are more comprehensive than the BTS's intermodal study as it includes all freight shipped by Class I railways. For the most part, the R-1 data follow the Trends noted in Figure 1 with one exception: the Soo Line saw an increase in traffic of over 45%. The Soo Lines business activities were investigated to understand the anomaly in their freight traffic data. The Soo Line acquired the Dakota, Minnesota and Eastern Railroad and the Iowa, Chicago & Eastern Railroad in late 2008. It is believed that this merger is the cause of the increased activity reported by the Soo line.

When all the rail traffic data are aggregated, the Soo line's freight traffic has a relatively small impact on the overall trend as it is the smallest of the Class I railways. The percent change from 2008 to 2011 for total ton-miles (including the Soo line) is -2.479.

Table 1. Class I Railroad Ton Miles Activity for 2008 and 2011

	Total Revenue Ton-miles of Freight (thousands)		Total non-Revenue Ton-miles of Freight (thousands)		Total Revenue and non-Revenue Ton-miles of Freight (thousands)		% change from 2008 to 2011
	2008	2011	2008	2011	2008	2011	
BNSF	664,384,072	648,431,637	5,997,398	6,117,197	670,381,470	654,548,834	-2.362
CSXT	248,121,469	228,394,651	347,234	1,216,165	248,468,703	229,610,816	-7.590
GTC	53,452,403	51,253,084	624,848	518,201	54,077,251	51,771,285	-4.264
KCSR	29,624,261	30,485,863	6,077	1,338,343	29,630,338	31,824,206	7.404
NS	195,343,113	191,712,562	273,331	1,267,931	195,616,444	192,980,493	-1.348
Soo	23,681,180	34,581,354	241,414	333,090	23,922,594	34,914,444	45.948
UP	562,629,694	544,397,317	5,187,410	5,485,720	567,817,104	549,883,037	-3.158
				Total	**1,789,913,904**	**1,745,533,115**	**-2.479**

ERG also tried to obtain rail freight trend data from the Association of American Railroads (AAR), but their current posted data only extend back to 2009. It was noted that the AAR data are used in the in the BTS's National Transportation Statistics and are similar to the data in Table 1.

Because Class II and III rail operations are often affected differently by changes in the economy than Class I railways, data were obtained from the American Short Lines and Regional Railroad Association to assess their growth rate for the study period. Unfortunately, freight traffic data in terms of ton-miles was not available, so information regarding employee hours for 2008 and 2011 were evaluated, quantifying a decline in activity of 8.37 percent. It is possible that this decline overstates the actual change in Class II and III rail traffic, as employee efficiency may also change during periods of economic uncertainty.

Lastly, it should be noted that growing the 2008 data using these measures does not account for improved locomotive efficiency. Because the price of railroad fuel increased over the study period and because fuel usage is such a large component of rail finances; when demand declines, railways often use their newer, more efficient locomotives and retire the older engines to reduce their system-wide fuel consumption. Under these conditions, less fuel would be needed to move cargo, suggesting that actual 2011 emissions may be slightly less than those estimated for this project.

3.0 Emissions Estimate Summary

The railroad component of the 2008 NEI was provided by ERTAC. ERTAC revised their data since the 2008 NEI was posted. Prior to scaling the 2008 data to represent 2011, the 2008 NEI data set was amended to include the updates in the latest version of the ERTAC data. Note there were no changes to the Class I line haul operations which represent the largest rail emission source. The latest 2008 ERTAC data set for Class II/III line haul operations contained additional state and railroad provided data as well as an updated fuel use factor. These revisions were re applied to the county level and re-aggregated to match the latest ERTAC data set. The yard

engine data also had slightly different emissions and record counts. The new yard emissions were summed and reallocated to new yards which were assigned unique IDs and EIS/GIS point locations.

The growth factors developed in Section 2 were applied to the updated 2008 railroad emission estimates using the following equation to approximate 2011 emissions:

$$EE_{2011ij} = EE_{2008ij} \times (1 + GF_i / 100)$$

Where:

EE_{2011ij}	=	2011 railroad emission estimate for operation type i and pollutant j (Tons/Yr)
EE_{2008ij}	=	2008 railroad emission estimate for operation type i and pollutant j (Tons/Yr)
GF_i	=	2011/2008 growth factor for operation type i (Class 1 railroad and all yard operations = -2.475percent and Class 2 and 3 operations = -8.37 percent)
i	=	Rail operation type (Class 1 line haul, Class 2 and 3 line haul, and yard operations)
j	=	criteria pollutant and regulated HAPs.

The 2011 emissions using the above approach are presented in Table 2 along with the updated 2008 values for each locomotive category. HAP emissions for each locomotive category are presented in the Appendix of this report.

Table 2. 2008 and 2011 Annual Emission Estimates by Locomotive Category (Tons)

	Class I		Class II/III		Switch		Total	
Pollutant	**2008**	**2011**	**2008**	**2011**	**2008**	**2011**	**2008**	**2011**
CO	110,969	108,218	4,631	4,244	9,231	9,002	124,830	121,463
NH_3	347	339	14	13	28	27	389	379
NO_X	754,433	735,731	47,035	43,100	74,431	72,586	875,899	851,417
PM_{10}	25,477	24,846	1,158	1,061	2,105	2,053	28,740	27,960
PM_{25}	23,439	22,858	1,065	976	2,042	1,991	26,546	25,826
SO_2	7,836	7,642	327	300	624	608	8,787	8,550
VOC	39,952	37,000	1,829	1,676	5,125	4,998	46,905	43,674

4.0 References

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Appendix A – 2011 HAP Emissions by Locomotive Category

Table A-1. 2011 HAP Emissions by Locomotive Category (Tons per year)

Pollutant	Class I Emissions	Class II/III	Switch	Total
1,3-Butadiene	113.899	4.866	9.186	127.950
2,2,4-Trimethylpentane	82.974	3.758	11.208	97.940
Acenaphthene	0.738	0.032	0.060	0.830
Acenaphthylene	10.413	0.445	0.850	11.708
Acetaldehyde	659.298	28.164	53.178	740.640
Acrolein	109.648	4.684	8.845	123.176
Ammonia	338.587	13.276	26.958	378.820
Anthracene	2.461	0.105	0.201	2.767
Arsenic	0.009	0.000	0.001	0.010
Benz[a]Anthracene	0.395	0.017	0.032	0.444
Benzene	90.721	3.875	7.317	101.913
Benzo[a]Pyrene	0.070	0.003	0.006	0.079
Benzo[b]Fluoranthene	0.157	0.007	0.013	0.176
Benzo[g,h,i,]Perylene	0.078	0.003	0.006	0.088
Benzo[k]Fluoranthene	0.128	0.005	0.011	0.144
Beryllium	0.696	0.030	0.058	0.783
Cadmium	0.696	0.030	0.058	0.783
Carbon Dioxide	--	1,617,263.311	3,283,729.797	4,900,993.109
Carbon Monoxide	108,217.732	4,243.692	9,001.821	121,463.245
Chromium (VI)	0.049	0.002	0.004	0.056
Chromium III	0.096	0.004	0.008	0.108
Chrysene	0.292	0.012	0.024	0.329
Ethyl Benzene	74.000	3.351	9.996	87.348
Fluoranthene	1.840	0.079	0.151	2.070
Fluorene	3.417	0.146	0.279	3.842
Formaldehyde	1,519.044	64.891	122.519	1,706.454
Hexane	203.501	9.216	27.490	240.207
Indeno[1,2,3-c,d]Pyrene	0.067	0.003	0.006	0.075
Lead	2.088	0.089	0.173	2.350
Manganese	0.051	0.002	0.004	0.057
Mercury	0.696	0.030	0.058	0.783
Naphthalene	63.268	2.702	5.193	71.163
Nickel	0.163	0.007	0.013	0.183
Nitrogen Oxides	735,730.789	43,099.979	72,586.140	851,416.909
Phenanthrene	13.805	0.590	1.127	15.521
PM_{10} Primary (Filt + Cond)	24,845.831	1,060.928	2,052.942	27,959.702
$PM_{2.5}$ Primary (Filt + Cond)	22,858.165	976.001	1,991.354	25,825.519

Table A-1. 2011 HAP Emissions by Locomotive Category (Tons per year)

Pollutant	Class I Emissions	Class II/III	Switch	Total
Propionaldehyde	225.701	10.222	30.489	266.411
Pyrene	2.591	0.111	0.213	2.914
Styrene	77.700	3.519	10.496	91.715
Sulfur Dioxide	7,641.578	299.635	608.406	8,549.619
Toluene	118.400	5.362	15.994	139.757
Volatile Organic Compounds	37,000.155	1,675.721	4,998.128	43,674.003
Xylenes (Mixed Isomers)	177.601	8.043	23.991	209.635

Appendix B-7

Technical Memorandum:
Preparation of Wildland Fire Emissions Inventory for 2011

Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

Technical Memorandum

August 15, 2012 STI-910321-5446

To: Venkatesh Rao, U.S. Environmental Protection Agency

From: ShihMing Huang, Yuan Du, Sean M. Raffuse, and Stephen B. Reid

Re: Preparation of Wildland Fire Emissions Inventory for 2011

The U.S. Environmental Protection Agency's (EPA) Emissions Inventory and Analysis Group (EIAG) compiles the National Emissions Inventory (NEI) and disseminates inventory data, summaries, model-ready files, and analyses based on the NEI. To support this program and the analyses conducted by a variety of users, Sonoma Technology, Inc. (STI) has developed an emissions inventory of wildland fires for the year 2011, as we did for the years 2006 through 2010.

This work was done via Work Assignment (WA) 3-21 under Contract No. EP-D-09-097. This technical memorandum describes the methods used to develop the 2011 fire emissions inventory, summarizes the 2011 fire activity and emissions data, and compares the inventories for the past five years.

Technical Approach

Data Sources

Fire activity data from the following sources were used to develop the 2011 fire inventory:

- Inputs to SmartFire 2 (SF2)
  - *HMS* data were acquired daily from the National Oceanic and Atmospheric Administration (NOAA) Hazard Mapping System (HMS) via FTP as part of a routine process. Data were acquired in ASCII text format available at http://satepsanone.nesdis.noaa.gov/FIRE/fire.html.
  - *ICS-209 Reports* in application (.exe) format were acquired via the Fire and Aviation Management Web Applications website (https://fam.nwcg.gov/fam-web/sit/). Upon execution, the application file created a Microsoft Access database containing the fire activity data.
  - *GeoMAC* fire perimeter data were downloaded via the United States Geological Survey (USGS) GeoMAC wildland fire support website (http://rmgsc.cr.usgs.gov/outgoing/GeoMAC/).

  - *Moderate Resolution Imaging Spectroradiometer (MODIS)* satellite data were downloaded via the USDA Forest Service (USFS) Remote Sensing Applications Center website (http://activefiremaps.fs.fed.us/gisdata.php). Data were converted from a shapefile to an ASCII text file and used to fill in the blank dates from HMS.
- *Fuel Moistures* – Fire weather observation files (fdr_obs.dat) were acquired for each analysis day from http://72.32.186.224/archive/www.fs.fed.us/land/wfas/archive. Files were acquired and combined for database ingest using Python scripts.
- *Fuel Loading* – Fuel Characteristic Classification System (FCCS) 1-km fuels shapefile and lookup table for the conterminous United States were provided by the AirFire Team. The Alaskan FCCS 1-km fuels shapefile and lookup table were acquired from the Fire and Environmental Research Applications Team's website (http://www.fs.fed.us/pnw/fera/fccs/maps.shtml).

Preparation of Fire Activity Data

SmartFire 2 was used to process and reconcile fire activity data from HMS, ICS-209 Reports, and GeoMAC fire perimeters (Pollard et al., 2011). An extra processing step in SmartFire 2 was taken in developing the 2010 Fire Emission Inventory as well as this emission inventory: fire activity data were reconciled twice. Duplicate events that should have been merged were still being found in the fire activity data after one round of reconciliation. Late satellite detection of fire reflected in the HMS dataset could result in double-counting with MTBS data. This specific issue is resolved through a second reconciliation pass. In future emission inventories, this issue can be minimized by increasing the starting date uncertainty for the HMS dataset. A comparison of the results from single and double reconciliation using 2010 fire activity data showed a decrease of 4% in total acres burned by wildfires after the second fire activity reconciliation.

In addition, SmartFire 2 was used to generate daily input files for emissions processing through the BlueSky Framework for wildland fires. MODIS data were used to gap-fill for dates on which data were missing from the HMS: December 30 and December 31, 2011.

Process Streams

The BlueSky Framework provides several choices of models at each step of the smoke modeling process. The model chain used for the conterminous United States and Alaska, where FCCS fuel loading data are available, is summarized in **Table 1**. A new version of Consume (version 4.1) has been implemented in the BlueSky Framework since the development of the 2009 Wildland Fire Emission Inventory, which was based on Consume version 3.0. The differences between versions 4.1 and 3.0 include bug fixes for duff reduction; litter, lichen, and moss reduction; squirrel midden fuel loading; and other minor errors.

A different model chain was used for fires in Hawaii and Puerto Rico, as summarized in **Table 2**, because FCCS data are not available in these regions. The Fire Inventory from NCAR (FINN) version 1 is capable of producing global emission estimates for wildland fires, and it therefore was used to develop the emission inventories for Hawaii and Puerto Rico. FINN utilizes satellite-derived land cover data, along with estimated fuel loadings and emission

factors, to model smoke emissions (Wiedinmyer et al., 2011). However, the emission factors of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) are not available in FINN.

Emission estimates of VOCs and HAPs from wildland fires in Hawaii and Puerto Rico were based on carbon dioxide (CO_2) outputs from FINN. The average ratios of VOCs and HAPs to CO_2 for wildland fires in grassland/herbaceous land cover, which is most similar to the vegetation type that burned in Hawaii and Puerto Rico, were calculated for the conterminous United States and applied to the CO_2 emissions of Hawaii and Puerto Rico fires to estimate VOC and HAP emissions.

Table 1. Model chain for the conterminous U.S. and Alaska portion of the 2011 Wildland Fire Emissions Inventory development.

Data Type	Model Used	Version No.
Fire activity data	SmartFire 2	Version 2.0, Build 891
Fuel loading	FCCS v2	As implemented in BlueSky Framework 3.3.0, revision 28153
Fuel consumption	Consume v 4.1	
Emissions	Fire Emission Production Simulator (FEPS) v2	

Table 2. Model chain for the Hawaii and Puerto Rico portion of the 2011 Wildland Fire Emissions Inventory development.

Data Type	Model Used	Version No.
Fire activity data	SmartFire 2	Version 2.0, Build 891
Fuel loading	FINN v1	As implemented in BlueSky Framework 3.3.0, revision 28153
Fuel consumption	FINN v1	
Emissions	FINN v1	

Emissions Processing

The following steps were applied to process fire activity data and estimate emissions for fires in the conterminous United States and Alaska:

1. *Assign fuel moistures* – Individual fire locations from SmartFire 2 prediction points were assigned to the nearest fire weather station reporting on that day using VBA code in AssignFuelMoisture.mxd. This code produced a lookup table (yyyyFandFW.csv) of fire IDs, station IDs, dates, and distances.
2. *Create BlueSky input file* – The daily input files for the BlueSky Framework (fire_locations_yyyymmdd.csv) were created using VBA code in CreateFireLocations.xls. Input tables were stored in the Microsoft Access database CreateFireLocInput.mdb, including the tables FireLocations_yyyy and yyyyFandFW. If the distance between the fire and the nearest fire weather station was greater than 300 km, default values were

assigned (fuel_moisture_10hr = 9 and fuel_moisture_1khr = 12 for wildfires; fuel_moisture_10hr = 12 and fuel_moisture_1khr = 25 for prescribed fires). Outputs were created in .csv format and saved directly to the BlueSky Framework input directory.

3. *Process through BlueSky Framework* – A module was customized for the BlueSky Framework to calculate HAP emissions using emission factors provided by EPA. The Framework is currently designed to process one day at a time. A shell script (batchEmissions) was used to process emissions one year at a time. The resulting files are daily BlueSky outputs.
4. *Process BlueSky Outputs* – The BlueSky Framework produces three output files for each day. For this project, we only required fire_locations_yyyymmdd.csv, which contains the same data as the input file, but with additional calculated fields (fuel loadings, fuel consumptions, and emissions) appended to each fire record. The daily files were concatenated using a Python script, ConcatFireLoc.py, into yearly files (yyyyFireLoc.csv) for ingest into the emissionsyyyy.mdb database and analysis.
5. *Post-process emissions* – There is a known issue existing in the Consume model. The algorithm does not behave properly for prescribed burns (RX) in areas with large duff depths. In such a case, Consume will overestimate the duff consumptions, resulting in considerably high consumptions and emissions. To solve the problem in a timely way before a new Consume version is released with the issue fixed, a post-processing procedure was applied to each RX to scale down phase-specific consumptions and daily total emissions. The scaling procedure was implemented in the development of the 2010 and 2011 Fire Emission Inventories, as well as the revised 2008 and 2009 Fire Emission Inventory. The scaling factor for each RX was derived according to its location and duff consumption. The step by step process was as follows:
   - New duff consumption of each prescribed burn was re-calculated by setting a “cap” value for the duff consumption. For burns in western states (all states west of Texas, plus the Dakotas), the duff consumption cap was set to 20 tons per acre. For eastern states, the duff consumption cap was set to 5 tons per acre. These caps were developed via expert judgment in consultation with USFS and U.S. Department of Interior experts. For each fire, the exceedance in duff consumption was calculated by subtracting capped duff consumption from the original duff consumption.
   - The new total consumption of each prescribed burn was calculated by removing the exceedance in duff consumption from the original total consumption.
   - A scaling factor for each prescribed burn was calculated as the ratio of the new total consumption over the original total consumption.
   - Finally, the burn-specific scaling factor was applied to phase-specific consumption (flaming, smoldering, and residual) and daily emissions of all pollutants to compute new fuel consumption and emissions.
6. *Prepare agricultural data* – BlueSky does not currently provide methods for estimating emissions from agricultural burns, and this inventory excludes agricultural fires. Fire activity data in the conterminous United States from SmartFire 2 were intersected with the U.S. Geological Survey 2006 30-m National Land Cover Dataset (NLCD), and fire activity data in Alaska, Hawaii, and Puerto Rico were intersected with the 2001 30-m

NLCD. NLCD classifies all area in the United States into one of 19 land cover types (**Figure 1**). Fires that fell within land cover types 81 (Pasture/Hay) or 82 (Cultivated Crops) were assumed to be agricultural burns and removed from the yyyyFireLoc table to make a yearly agricultural fire table (AgActivityClean) in the emissionsyyyy.mdb database.

7. *Preparing wildland fire data* – yyyyFireLoc table in the emissions.mdb database was formatted into the final emission inventory table (WF_locations_All) after filtering out the agricultural burn data.

The emissions processing steps 1 to 5 were omitted for Hawaii and Puerto Rico wildland fires because the model chain used in the BlueSky Framework was different. FINN does not require fuel moisture data, nor does it need daily fire activity input files. The activity data of fires in Hawaii and Puerto Rico were input into the BlueSky Framework in one single file, and the output file, fire_locations.csv, contained the fuel consumptions and emissions data for all fires in the input file. The outputs were first post-processed to estimate VOC and HAP emissions as described previously in the “Process Streams” section, appended to the yyyyFireLoc table in the emissionsyyyy.mdb database, and finalized for this emissions inventory through steps 6 and 7.

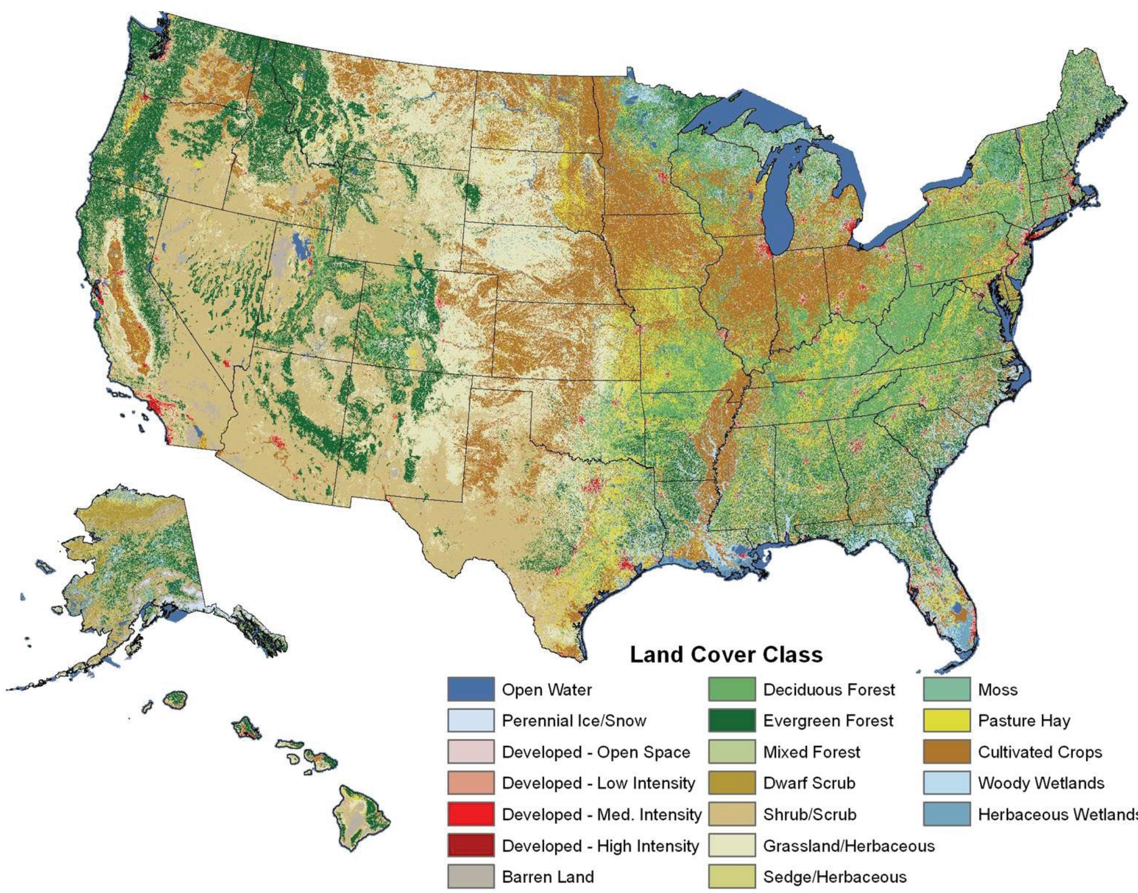


Figure 1. NLCD map used to identify and segregate agricultural burns. Puerto Rico data are not shown in this figure.

Emissions QA/QC

For the 2011 fire inventory produced with SmartFire 2, several steps were taken to QC the data and confirm that the algorithms and datasets incorporated into SmartFire 2 worked appropriately.

Before Running SmartFire 2:

- We reviewed input datasets and identified any data gaps that needed to be filled with alternative data (e.g., gaps in HMS data were filled with MODIS data).
- We identified fire incidents that appeared to be double-counted in individual data sets and removed duplicate records.
- We examined fires with long durations or conflicts between start date and report date to identify fires that may have erroneous start dates. Start dates later than report dates were replaced with the report dates.
- We spot-checked reported location coordinates for selected fires.

After Running SmartFire 2:

- We checked the location, duration, underlying fire activity input data, final shape, and final size for large fire events (i.e., area burned > 10,000 acres) to ensure that the results were reasonable.
- We checked large fire events (i.e., area burned > 10,000 acres) by state and by name and removed duplicate events.
- We produced and reviewed summary tables and plots of the 2011 fire inventory data.
- We compared acres burned by state to National Interagency Fire Center (http://www.nifc.gov/fireInfo/fireInfo_statistics.html) data to make sure the summary values are within reasonable range.

Summary of 2011 Wildland Fire Emission Inventory

We estimated that, in 2011, wildland fires burned over 23 million acres in the United States and emitted more than 2.6 million tons of $PM_{2.5}$. The area burned by wild and prescribed fires make up 43% and 57% of the total area burned, respectively. Wildfire $PM_{2.5}$ emissions account for 67% of the total emissions and prescribed burns account for 33%.

In the 2011 Wildland Fire Emission Inventory, the bulk of emissions originate from two regions: the West and the Southeast. This concentration of emissions is consistent with previous national fire inventories prepared by STI for EPA and can be seen in the emissions density plot shown in **Figure 2**. **Figure 3** depicts the total monthly $PM_{2.5}$ emissions for each state. The springtime emissions are mostly from the southeastern states, where prescribed burning is a common land management practice in spring. The summer/fall emissions occur primarily in the West and Southwest, particularly in California, Oregon, Arizona, and New Mexico. **Figures 4 and 5** depict the area burned per square mile by county for wildland fires and total area burned by county for agricultural fires, as calculated by SmartFire 2.

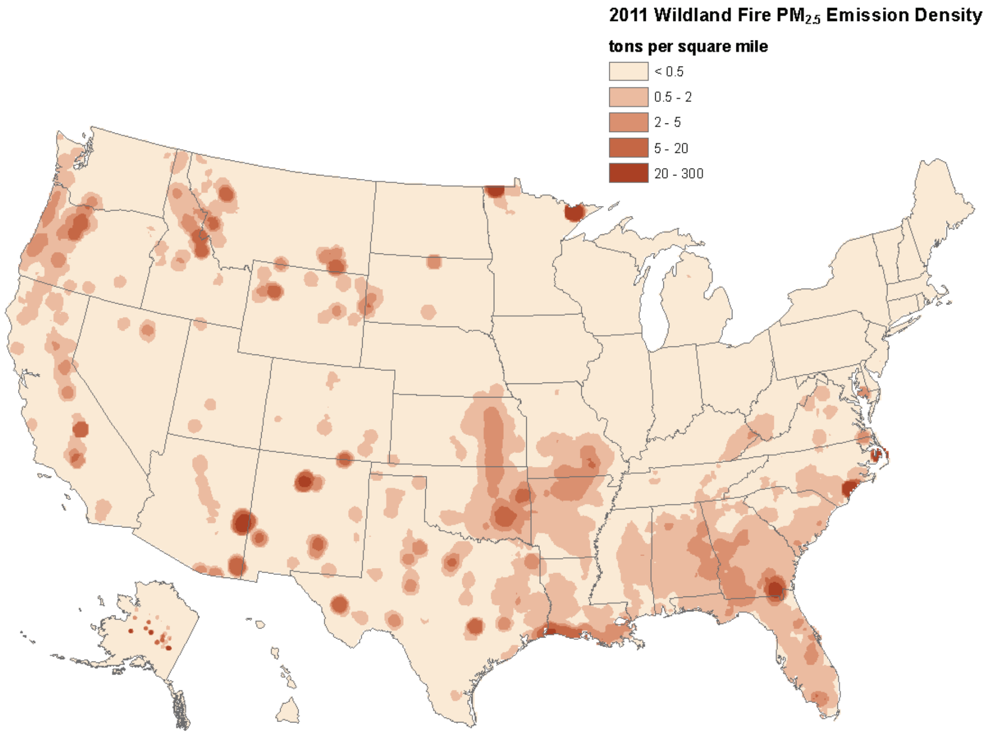


Figure 2. 2011 wildland fire $PM_{2.5}$ emission density. Puerto Rico data are not shown in this figure.

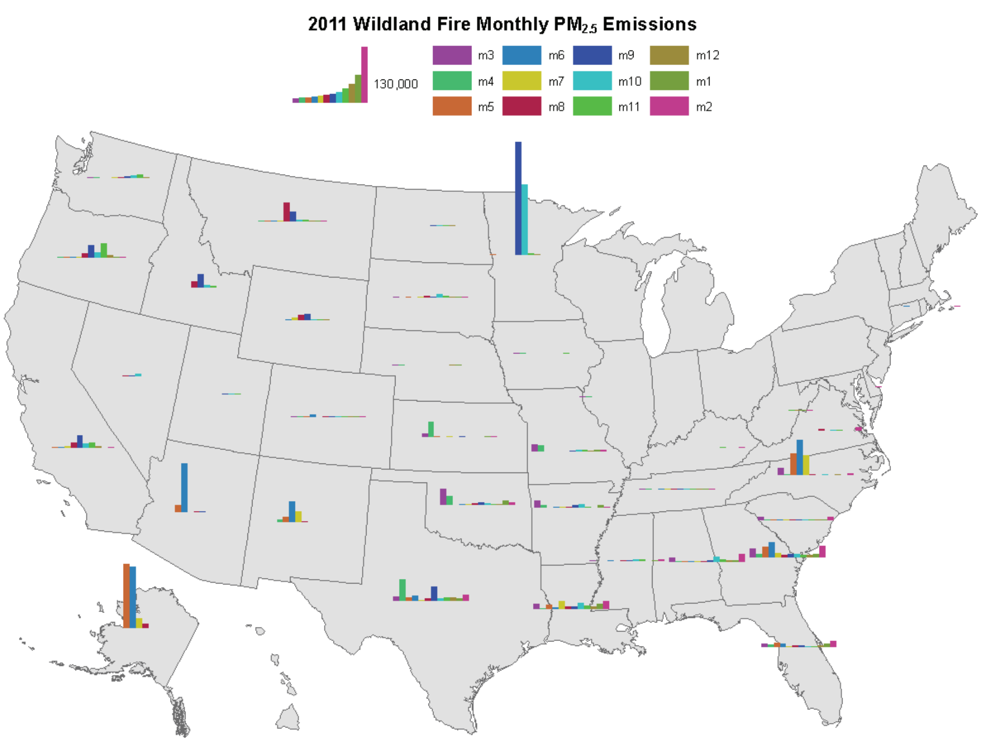


Figure 3. 2011 total monthly $PM_{2.5}$ emissions (tons) from wildland fires by state. Puerto Rico data are not shown in this figure.

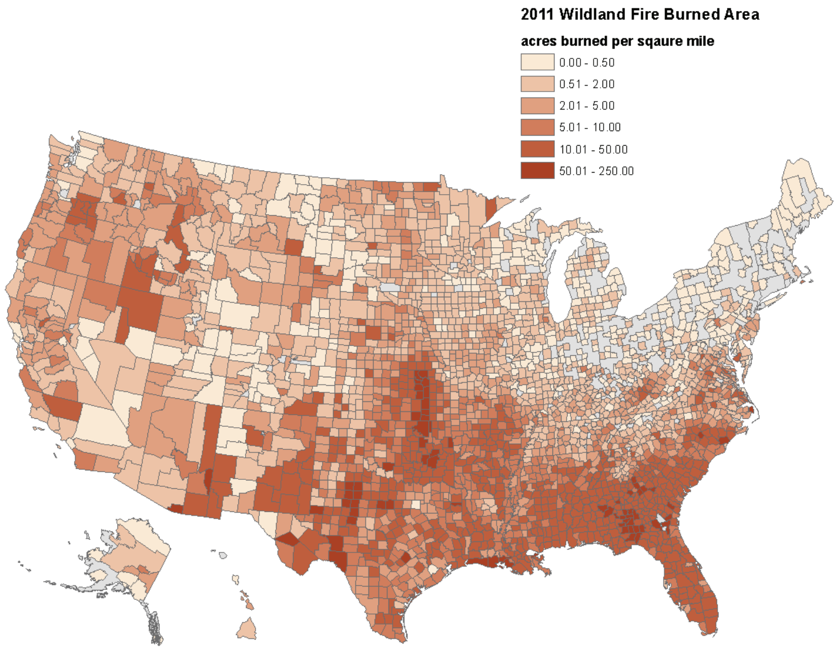


Figure 4. 2011 wildland fire area burned (acres per square mile) by county. Puerto Rico data are not shown in this figure.

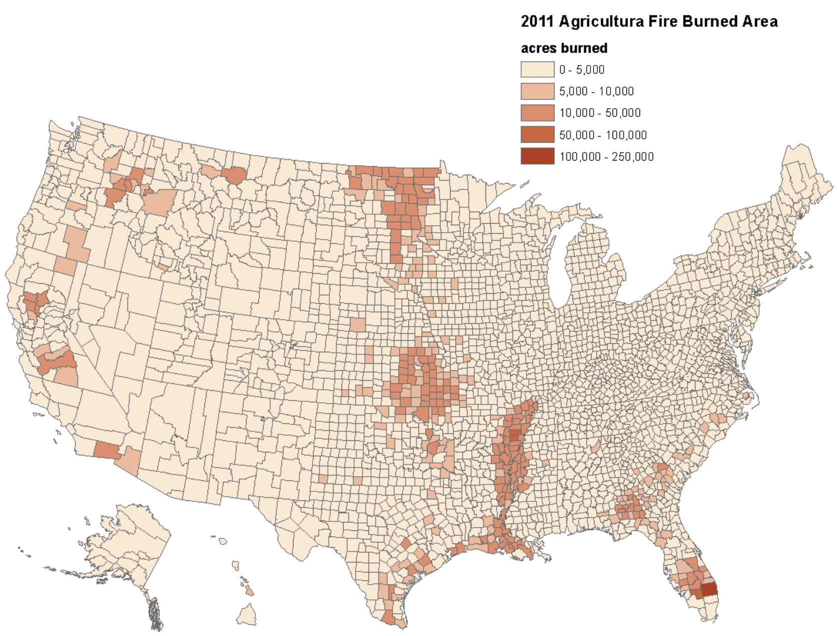
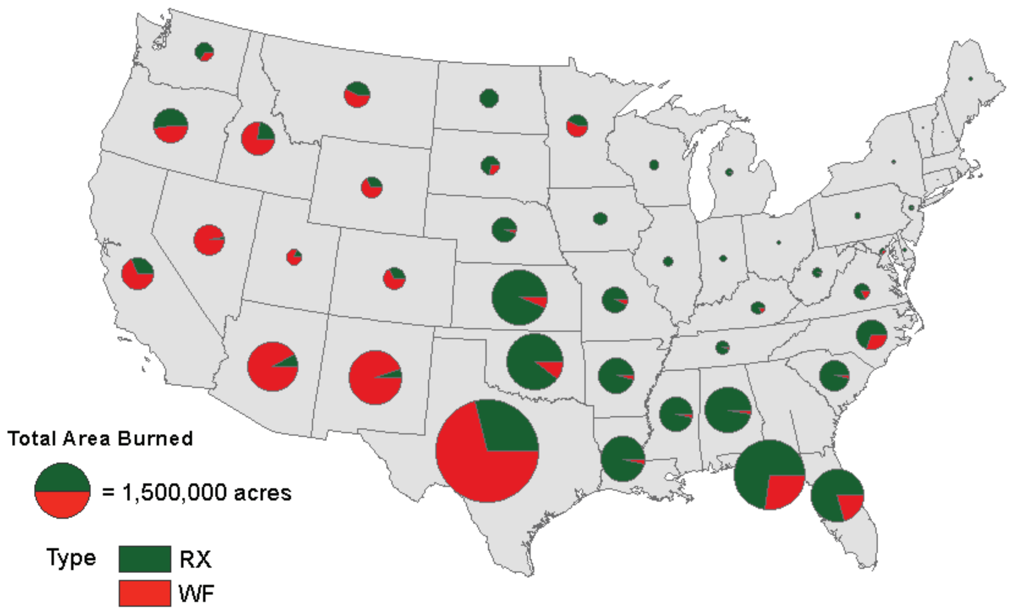


Figure 5. 2011 agricultural fire total area burned (acres) by county. Puerto Rico data are not shown in this figure.

Area burned and $PM_{2.5}$ results by state and fire type are presented in **Figure 6**. Large totals of area burned are present throughout the Southeast, the Southern Plains, Southwest,

and West. State totals of area burned are dominated by prescribed burning in most of the states on the eastern half of the country. Conversely, the emissions pattern is dominated by wildfires in Minnesota, North Carolina, and most of the states in the western half of the country.



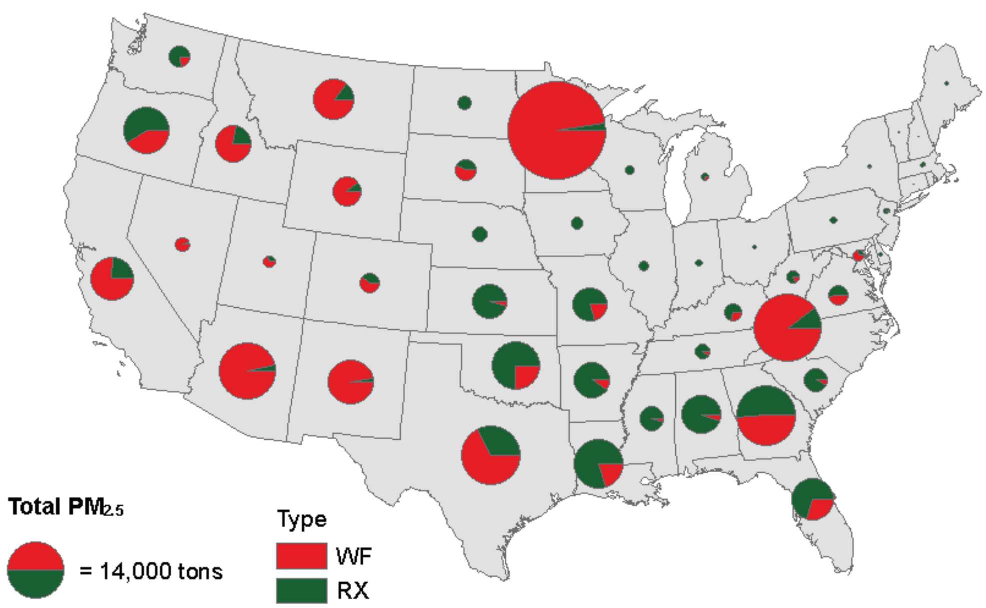


Figure 6. State totals of area burned (top) and $PM_{2.5}$ emitted (bottom) by fire type. Pie sizes are proportional to state totals. Each pie consists of two components: prescribed fire (green) and wildfire (red). Alaska, Hawaii, and Puerto Rico data are not shown in this figure.

The monthly patterns of area burned and $PM_{2.5}$ emissions are shown in **Figures 7 and 8**. In this inventory, the peak season for area burned is late winter/early spring, but the peaks of $PM_{2.5}$ emissions are in early summer and fall. This difference is a result of the offset between the prescribed and wildfire burning seasons and the larger relative emissions per area burned for wildfires. In 2011, substantial wildfire activities in the southwest (particularly Arizona and New Mexico) and Alaska resulted in the peak of $PM_{2.5}$ emissions in June. The Pains Bay fire and Juniper Road fire in North Carolina also contributed significant emissions in June from the smoldering of organic soil. The Pagami Creek fire in Minnesota burned from late August through October, consumed an extensive amount of duff fuels, and in turn resulted in the emission peak in September.

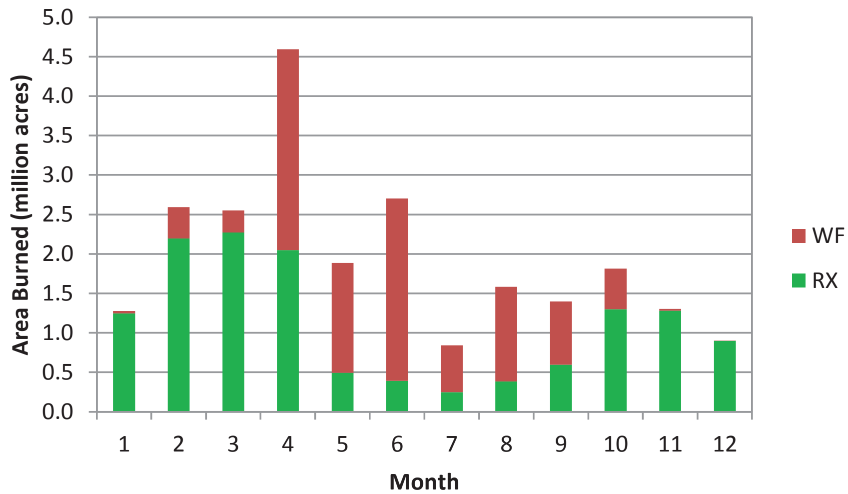


Figure 7. Monthly area burned in the United States in 2011 by fire type. Red indicates wildfires and green indicates prescribed burns.

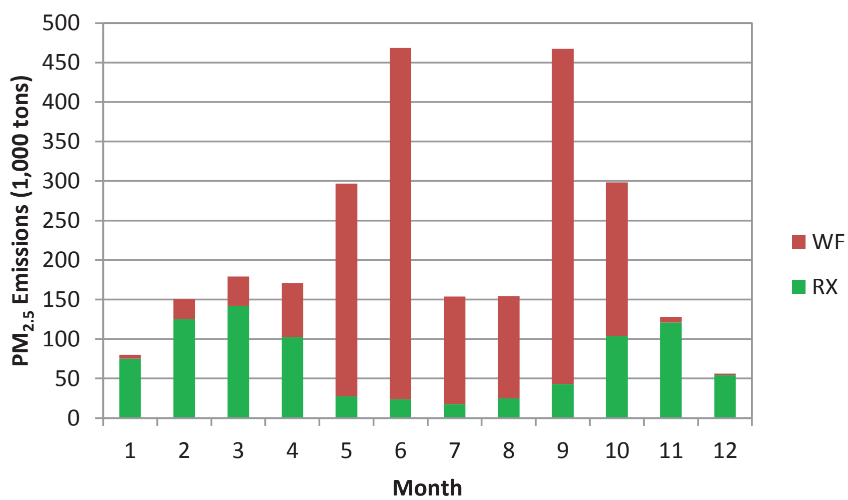


Figure 8. Monthly $PM_{2.5}$ emitted from wildland fires in the United States in 2011 by fire type. Red indicates wildfires and green indicates prescribed burns.

Comparison with Previous Years

The 2011 Wildland Fire Emission Inventory was compared with prior years' inventories developed by STI for EPA. **Figure 9** displays the temporal variability in $PM_{2.5}$ emissions from wildland fires in the contiguous United States in the past five years (from 2007 to 2011). The total wildland fire $PM_{2.5}$ emissions in 2011 are within the range shown in recent years. An apparent contrast in the temporal variability between emissions from wildfires and from prescribed burns demonstrates that wildfire smoke emissions vary significantly from year to year, whereas the differences in prescribed burn emissions over time change at a much smaller magnitude. The trends acknowledge the unpredictable nature of wildfire occurrence and indicate that the managed practice of prescribed burns takes place more or less regularly and consistently over the years.

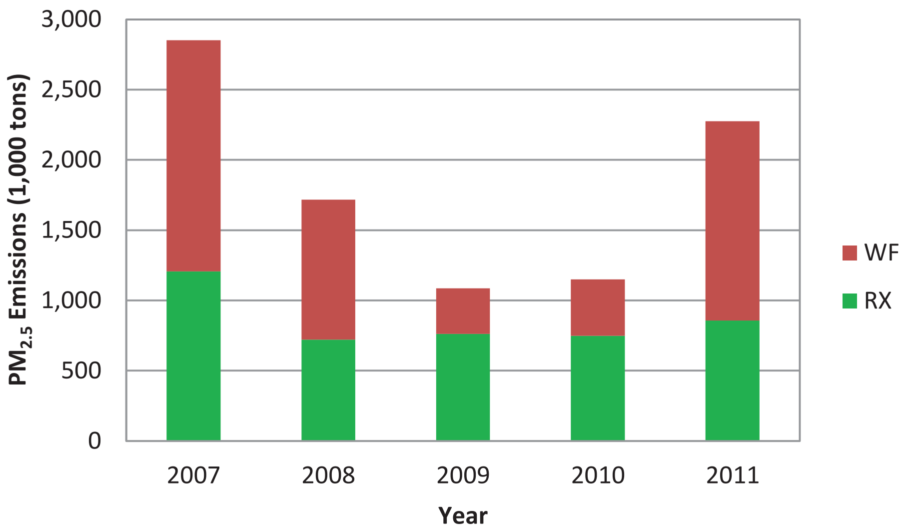


Figure 9. Total $PM_{2.5}$ emissions from wildland fires in the contiguous United States from 2007 to 2011, separated by fire type (WF = wildfires; RX = prescribed fires).

The spatial distributions and densities of $PM_{2.5}$ emissions from wildland fires in the contiguous United States from 2007 to 2011 are illustrated in **Figure 10**. The emissions are consistently concentrated in the western and southeastern states over the five-year period. As discussed previously, prescribed burning is practiced commonly in spring in the southeastern United States, and western states are prone to wildfires under dry conditions in summer. The locations of large wildfires are represented by dark red spots on the maps where high amounts of $PM_{2.5}$ were emitted, and the locations are different every year.

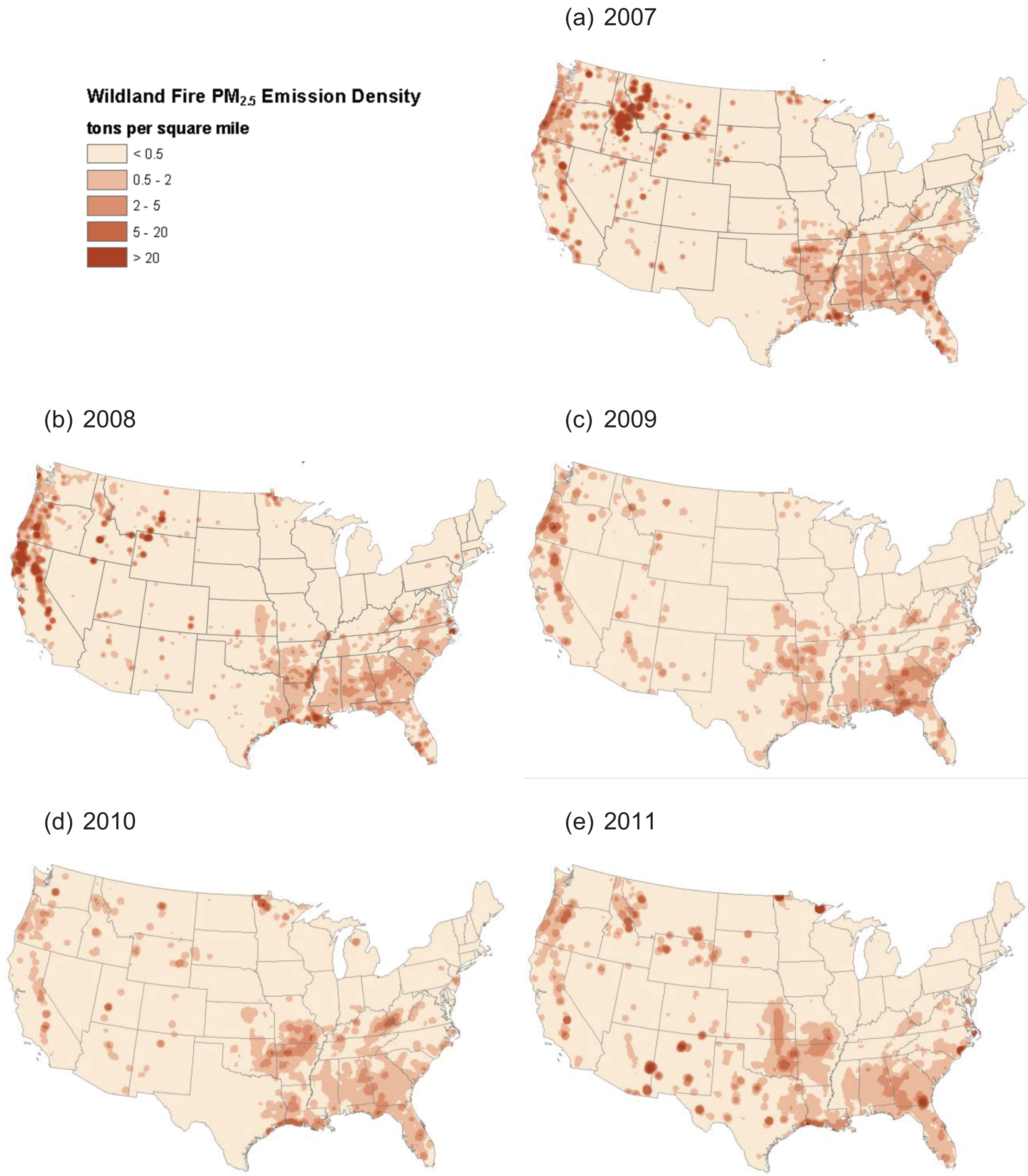


Figure 10. Annual wildland fire $PM_{2.5}$ emission density in the contiguous United States estimated for year (a) 2007, (b) 2008, (c) 2009, (d) 2010, and (e) 2011.

Deliverables

STI is providing the 2011 Wildland Fire Emission Inventory in the following formats:

- Microsoft Access files formatted identically to those prepared for the previous efforts (WA 5-17 under Contract No. EP-D-05-004 and WA 2-21 under Contract No. EP-D-09-097).

- EIS Events format, which consists of Microsoft Access-based “staging tables” that can be converted to XML format by EPA’s Consolidated Emissions Reporting Schema (CERS) XML file generator and uploaded to EIS. STI populated the Access staging tables with 2011 fire emissions data and produced separate Access databases for each state.

In addition, STI is providing all relevant daily and aggregated data and metadata in Microsoft Access or Excel tables.

References

Pollard E.K., Du Y., Raffuse S.M., and Reid S.B. (2011) Preparation of wildland and agricultural fire emissions inventories for 2009. Technical memorandum prepared for the U.S. Environmental Protection Agency, Research Triangle Park, NC, by Sonoma Technology, Inc., Petaluma, CA, STI-910221-4231, October 6.

Wiedinmyer C., Akagi S.K., Yokelson R.J., Emmons L.K., Al-Saadi J.A., Orlando J.J., and Soja A.J. (2011) The Fire INventory from NCAR (FINN): a high resolution global model to estimate the emissions from open burning. *Geosci. Model Dev. Discuss.,* **3**, 2439-2476 (doi:10.5194/gmd-4-625-2011). Available on the Internet at http://www.geosci-model-dev.net/4/625/2011/gmd-4-625-2011.pdf.